MACHINERY

Design—Construction—Operation

Volume 40 | FEBRUARY, 1934 | Number 6

The Wide Range of Gear-tooth Grinding **will be the Leading Article in March MACHINERY. Dealing with a subject of unusual timeliness, it shows how the grinding of gear teeth is now successfully applied all the way from the huge driving gears for electric locomotives down to gears as small as one-half inch in diameter. Another article will tell** ***What a Machine Designer Should Know About Electric Motors.*** **Articles on** ***Honing of Interrupted Bores*** **and** ***Taper Turning on Vertical Boring Mills*** **will also be featured.**

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MACHINERY

Volume 40 NEW YORK, FEBRUARY, 1934 Number 6

The Dies Behind Those Streamlines

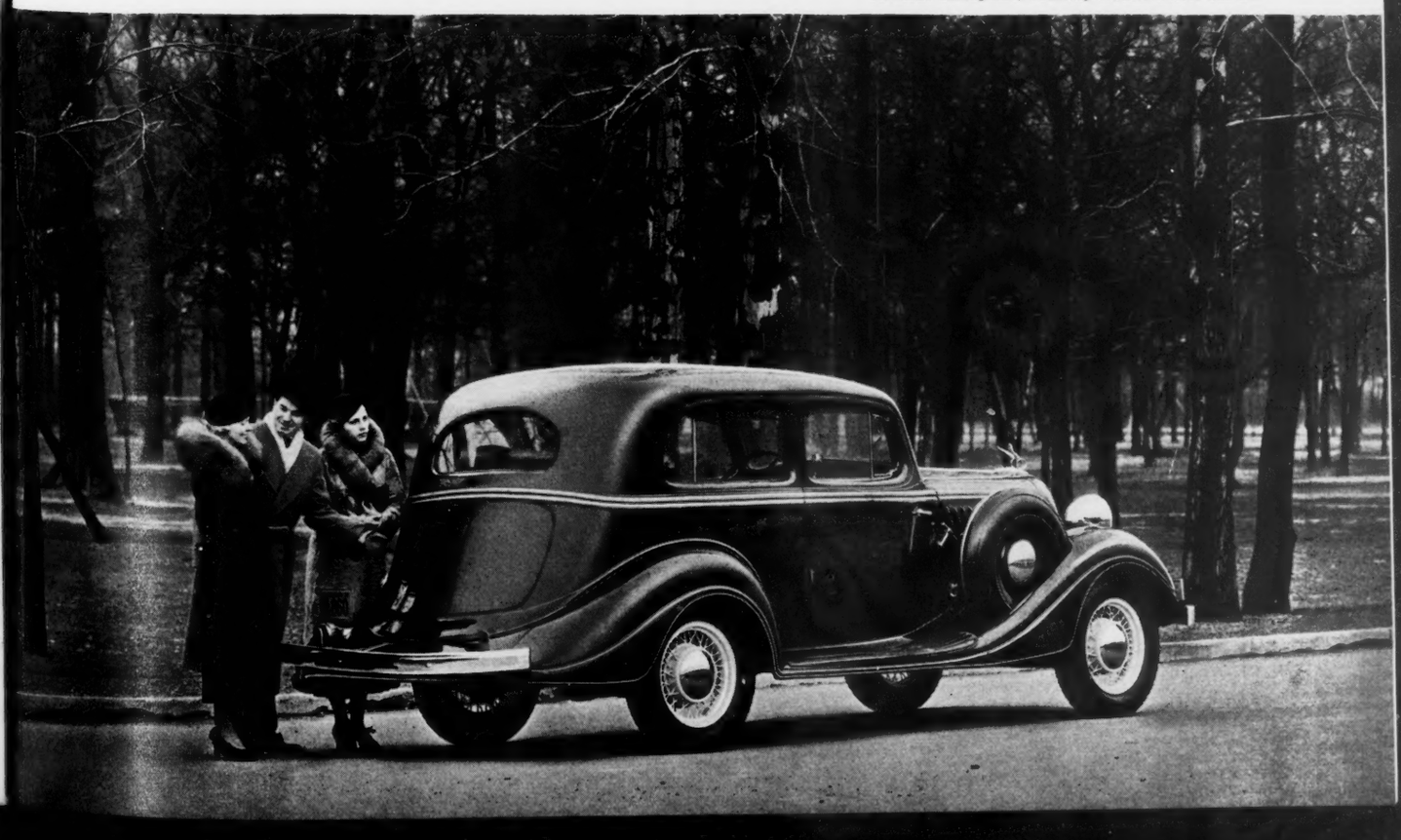
Tons and Tons of New Dies are Required Each Time the Appearance of an Automobile is Changed

By CHARLES O. HERB

YEAR after year, automobile manufacturers strive to win popular approval of their cars by bringing out new models. While new features incorporated in the engine, transmission, or other mechanical details are important, the approval of the prospective customer depends largely upon the appearance of the car, and so almost every new model has a different radiator, a different body, and a different fender design from its predecessor. These innovations are remarkably striking in the automobiles on exhibit at this year's shows.

The average automobile owner has little conception of the tremendous cost to the manufacturer of car appearance. Tons and tons of dies are required for the body panels, fenders, radiator shell, and engine hood of a car. Each time a contour is changed, alterations are necessary in the dies that produce the affected part, and when a new model is brought out, a complete set of dies is invariably necessary. One assembled die may weigh as much as 40 tons, while all the dies for an automobile may weigh as much as 300 tons.

The 1934 Terraplane, Courtesy Hudson Motor Car Co.



A number of large shops have been established in the automobile manufacturing areas for the sole purpose of producing dies of this classification. One such shop is the City Machine & Tool Co., Toledo, Ohio, which produces about six hundred dies a year, weighing over 2000 tons and costing around $1,250,000. This represents about 350,000 hours of labor. The shop has a floor space of approximately 40,000 square feet and normally employs from 200 to 250 skilled mechanics.

When an order for dies is obtained, the die shop is generally supplied with drawings only of the proposed stampings, although some customers also furnish specifications outlining the different power press operations contemplated in producing the stampings. It is then up to the die shop to design the dies to meet the requirements. This necessitates the maintenance of a fair-sized engineering department, which, in the case of the shop referred to, employs an average of thirty designers.

Although months of hand work are involved in producing many of these large dies, the amount of hand work has been greatly reduced through the use of five Keller automatic tool-room machines of various sizes, which are now built by the Pratt & Whitney Co. The huge Keller machine shown in Fig. 1 will accommodate dies weighing as much as eight tons. This machine has an over-all height of 18 feet and weighs approximately thirty tons. Before this machine was purchased, hand chipping, grinding, and filing on the large dies often required nine months. Now the hand work on similar dies has been reduced to three months at the most. Generally speaking, the dies are iron castings with inserts of tool steel provided at the points where drawing, blanking, or forming is done. Die dimensions are usually held to specified sizes within plus or minus 0.007 inch. Steel stock from No. 12 to 20 gage is generally used for automobile bodies, fenders, and similar parts.

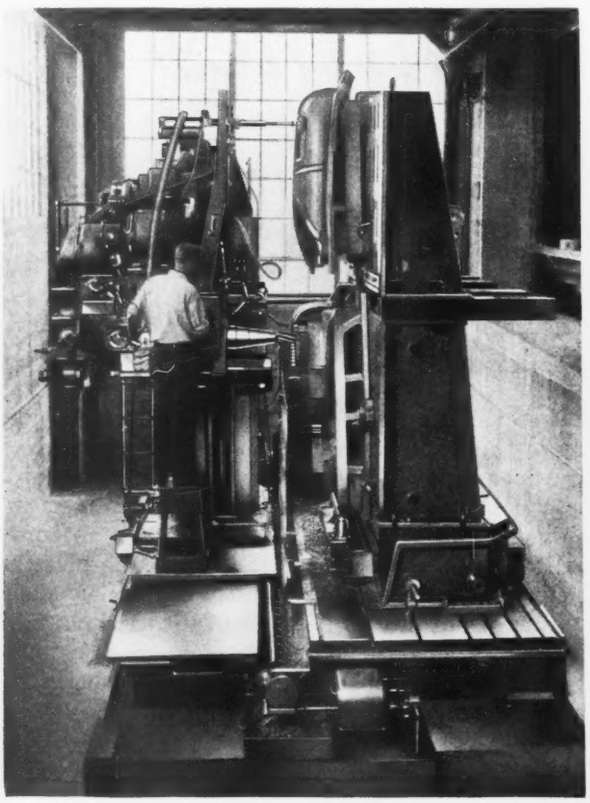
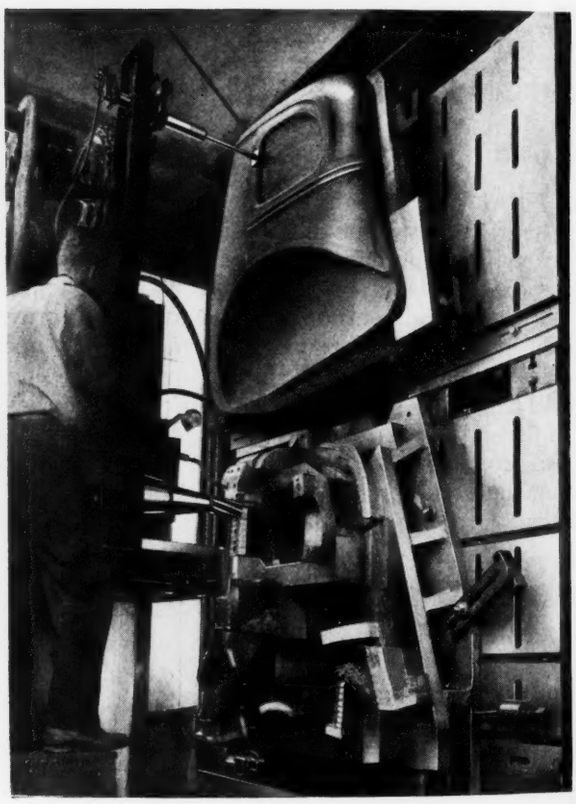


Fig. 1. Automobile Body Die Members Weighing up to Eight Tons are Handled on This Huge Automatic Tool-room Machine

Fig. 2. From the Master Model Shown, which may be of Wood or Plaster, Contours Can be Reproduced Accurately on the Die Below



Templets Facilitate Laying Out and Scribing

Center lines, contours, etc., are carefully laid out and scribed on the castings from which the dies are made before they are routed to the machining departments. Fig. 3 shows how a large panel die for a sedan body is made ready for machining. After such a casting has been set up vertically on a surface plate, as shown, Prussian blue is painted along

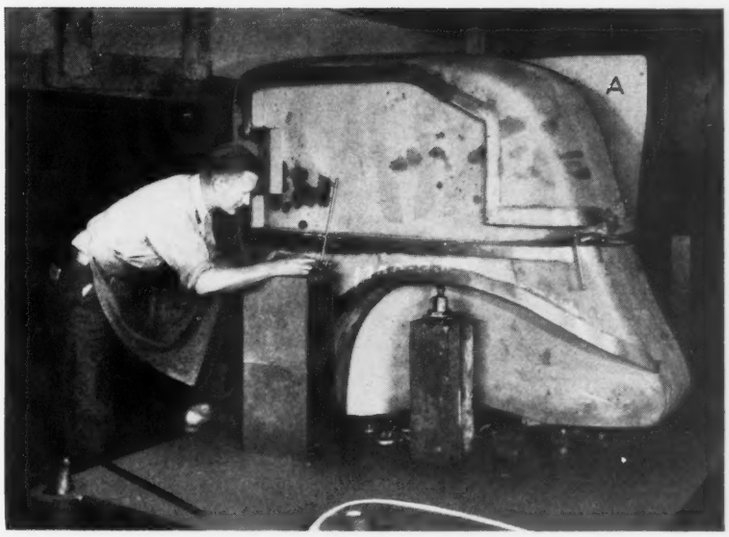


Fig. 3. In Scribing this Body Panel Die, the Various Heights and Center Lines are Transferred from a Templet at the Back

the surfaces to be scribed and prick-punched. A sheet-steel templet on which the center lines and outlines that are to be scribed on the work have been laid out is clamped to the back of the die, as shown at *A*. This templet is so mounted that its various heights can be conveniently transferred to the front side of the die by means of parallel blocks and a height gage, as illustrated. Center lines only are required for operations to be performed on the automatic tool-room machines.

After the casting has been laid out and scribed, the top or bottom and other flat surfaces are planed to a smooth finish. Then edges or other surfaces may be milled, a typical milling operation on a Cincinnati machine being illustrated in Fig. 4. When planing and milling have been completed, the casting is ready for one of the Keller machines.

Ideal Work for Automatic Milling

Blanking, forming, drawing, and trimming dies are milled readily to all sorts of outlines or contours in the automatic tool-room machines through the use of master forms or models. Both the master form and the work are mounted on the vertical platens of the stationary column seen at the right in Fig. 1. The master form is mounted above the work, as may be seen more clearly in Fig. 2. In these illustrations, a trimming die for a body panel is being milled. The same master form, which is made of pattern wood, was used in milling the forming die. Wooden master forms are used for the male part of the die, while plaster forms, molded from the wooden forms, are employed for milling the female die members.

The milling cutter is moved in and out to produce the desired contour on the work by corresponding movements of a tracer on the master form. The tracer is mounted on a bracket above the milling cutter and the distance between the two is adjusted accurately to suit the distance between the work and the master form. The movements of the tracer cause electrical contacts to be made which energize and de-energize magnetic clutches to control the movements of the cutter-spindle.

Vertical movements of the cutter and tracer are

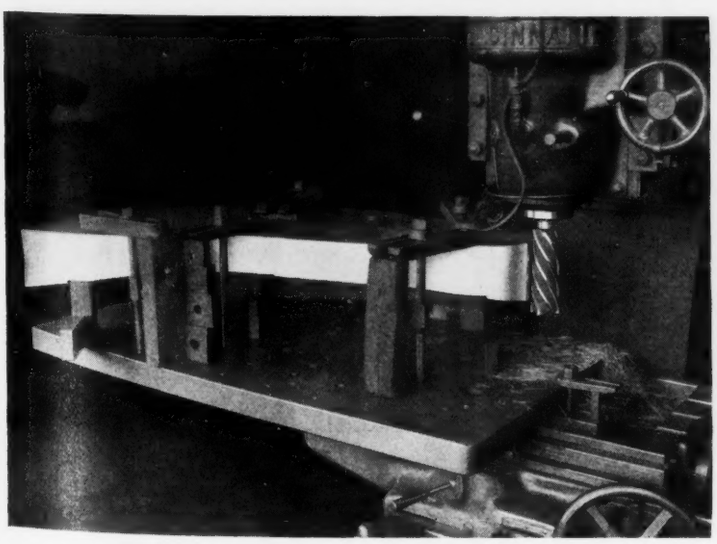


Fig. 4. After the Flat Surfaces have been Planed, the Edges of the Dies and Many Inside Profiles are Made Ready for Hand Finishing by Milling

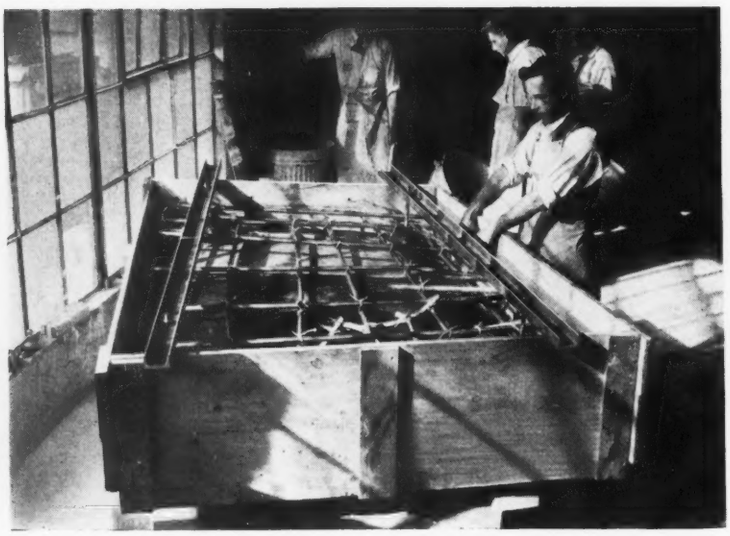


Fig. 5. Huge Plaster Forms are Reproduced from the Wooden Models for Use in Machining the Female Die Parts

obtained by feeding the cutter-head vertically, while horizontal movements of the cutter and tracer are effected by moving the main column along the ways of the base. Full electrical control of the machine movements is provided through push-button stations on the cutter-head. Two-dimensional or three-dimensional profiling can be performed.

The finer the feeds employed in the operation of automatic tool-room machines, the less the hand work required for finishing the die surfaces. In taking roughing cuts on either steel or cast iron, the depth of cut ranges up to 5/8 inch and the feed to about 1 inch. With finishing cuts, the depth averages 3/32 inch and the feed is taken to suit.

From Fig. 1 it will be apparent that the platen on which the model is mounted can be positioned farther front or back than the work in order to meet various conditions. The setting up of a job such as illustrated can be done in less than three hours.

Wooden master forms are generally purchased by the City Machine & Tool Co., but the plaster

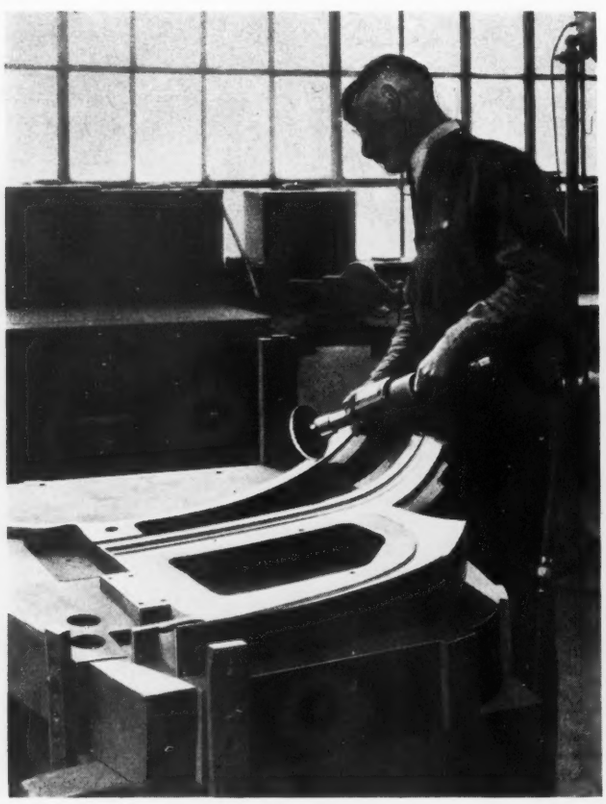


Fig. 6. Hand Work is of Great Importance in Finishing the Irregular Contours

Fig. 7. Putting the Finishing Touches on a Forming Die for a Rear Window

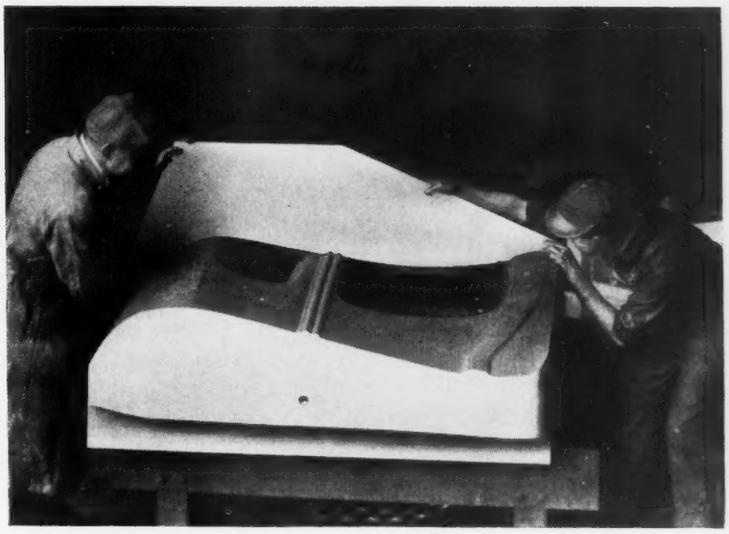


Fig. 8. From Time to Time the Contours of the Dies are Carefully Checked by Means of Sheet-steel Templets

forms reproduced for use in machining the female die parts are made by the company. For this operation, the wooden master is enclosed in a frame or box, as shown in Fig. 5. A frame of reinforcing steel rods, tied together, is suspended from two channel irons laid across the top of the box. When the plaster form has been completed, these channel irons provide a means of attaching it to the automatic tool-room machine and of handling the model by cranes.

After a mold has been prepared as shown in Fig. 5, liquid plaster made from Certrock (a product of the Certain-teed Products Corporation) is poured into the box until it is level with the top. The pouring must be done quickly, so that the entire mold will solidify in one piece. Ten-gallon tubs are used and fifteen men are engaged in the operation—three men for shoveling the plaster into the tubs and twelve men for pouring. A mold such as illustrated would require about 1000 pounds of plaster alone, without the water that must be added. This mold would solidify in about three-quarters of an hour.

After the wooden box has been removed from the solid plaster, a line is scribed carefully entirely around the plaster to serve as a reference in setting up the mold on one of the Keller machines. This scribing is done with a height gage while the plaster mold still rests on the wooden master, both being positioned on a surface plate.

When all possible machining has been done on a die, it is sent to another department where every contour or other surface is smoothed to the necessary high finish by filing, chipping, and grinding. These operations are performed with hand tools in the manner shown in Figs. 6 and 7. From time to time, the surfaces are checked by means of sheet-steel templets, as illustrated in Fig. 8.

As the two members of the die unit approach the finished stage, they are carefully fitted together, as shown in Fig. 9. Prussian blue is applied to the surfaces of one member, so that high spots can be detected and ground or filed away until the desired degree of perfection has been attained. Cranes are employed in this fitting because of the great weight of the die parts. In Fig. 9, a drawing die for a sedan body panel has just about been completed. The suspended member of this die weighs approximately six tons.

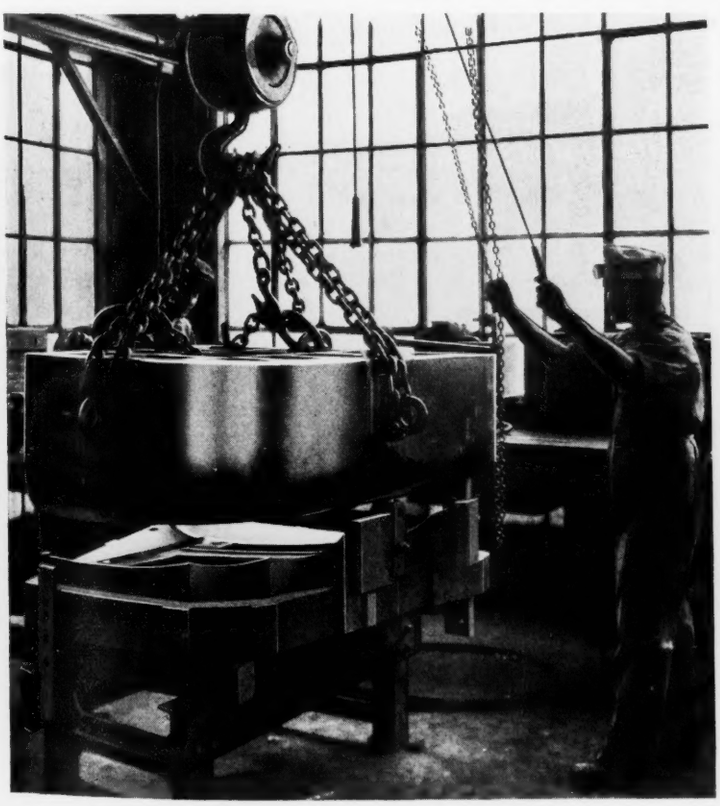


Fig. 9. Matching the Two Members of the Die to Locate Any High Spots

Washing Equipment for Castings

The Pangborn Corporation, Hagerstown, Md., has just completed the installation of equipment designed to clean steel castings ranging in size from small gears to large frames weighing 15 tons, at the Bucyrus-Erie Co.'s plant, South Milwaukee, Wis. The cleaning is done by the application of water under pressure of from 300 to 400 pounds per square inch.

Formerly the core sand, core rods, and gaggers from these steel castings were removed by a crew of men using pneumatically operated poke-out bars —a slow and dirty process involving many hours of tedious work. Now the cleaning is accomplished by only three men—the craneman, the hookman, and the room operator—under conditions that eliminate all dust and dirt at a great saving in time. A 15-ton casting previously requiring about 35 hours to clean is now finished in from 1 1/2 to 2 hours.

The casting washer consists of a steel room 25 feet square on the inside, with an over-all height from the floor level of about 18 feet. Two front doors provide an opening 15 feet wide by 16 feet high for moving castings in and out of the room. An opening in the top of the room permits the use of a traveling crane for placing the work on the turntable in the center. This turntable has a capacity of 50 tons and is operated by a 10-horsepower, waterproof motor. It is fitted with T-slots and holes for securing the work.

Two operating stations are located at one corner of the room, one above the other. Shatterproof windows located directly above the water nozzles permit the operator to see the work in the room and to direct the nozzles. At both stations the operator has control of the water pump, the nozzles, the movement of the rotary table, and the interior lights. The water consumption is small, since the water is used over and over again.

* * *

Awards for Long Service

Early in January, Ambrose Swasey, chairman of the board of the Warner & Swasey Co., Cleveland, Ohio, presented five gold watches to five men who have been in the company's employ twenty-five years each. The custom of presenting a gold watch to men who have been in the company's service for twenty-five years was started in 1920 on the occasion of the company's fortieth anniversary. Up to the present time, the total number of employes with a twenty-five-year record is fifty-seven.

The recipients this year are: E. W. Gressle, a member of the sales department; Henry J. Dengler, foreman; William M. Earley, fireman; Berger Swanson, lathe operator; and Cornelius Boehnlein, elevator operator. Mr. Gressle is the youngest man ever to receive this award. George A. Decker, works engineer, who received the award in 1920, is now in his fifty-first year with the company.

The Automobile Industry in 1933

The following statistics pertaining to the automobile industry in 1933 have been published by the National Automobile Chamber of Commerce:

Number of cars and trucks built in the United States and Canada	2,048,000
Passenger cars	1,685,000
Motor trucks	363,000
Increase in production over 1932, in per cent	43
Wholesale value of cars	$795,200,000
Wholesale value of trucks	$175,000,000
Wholesale value of cars and trucks combined	$970,200,000
Average factory price of cars	$630
Average factory price of trucks	$645
Wholesale value of parts and accessories	$425,728,000
Wholesale value of replacement rubber tires	$260,000,000
Gasoline consumption, retail value	$2,227,000,000
Number of passenger cars registered	20,525,000
Number of motor trucks registered	3,195,000
Number of motor vehicles registered in the world	32,820,000
Percentage of world's automobiles in the United States	72
Expenditures on highways and streets	$1,550,000,000
Total motor vehicle user taxes	$1,170,000,000
Total gasoline taxes	$716,000,000

* * *

An Industrialist Deals with Inflation

A booklet entitled "Inflation Delays Recovery" has been published by Allen W. Rucker in collaboration with N. W. Pickering, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn. Copies may be obtained from the company. It is pointed out that until the capital-goods industries are given freedom to revive in natural fashion, there can be no sustained and sound recovery in the nation's business, and no far-reaching, permanent relief of unemployment. Commendable as are the aims of the Administration, says the booklet, it is apparent that industrial re-employment on a large scale cannot be achieved until those factors which are retarding business are removed.

* * *

American Gear Manufacturers Organize Code Supervisory Agency

The code authority of the gear-manufacturing industry consists of the following members: H. H. Kerr, Boston Gear Works, Inc., chairman; J. C. McQuiston, Wilkinsburg, Pa., secretary; R. C. Ball, Philadelphia Gear Works; Richard Ferguson, Ferguson Gear Co.; Howard Dingle, Cleveland Worm & Gear Co.; F. H. Fowler, Foote Bros. Gear & Machine Co.; and F. B. Drake, Johnson Gear & Mfg. Co., Ltd.

Designing Dies for Forming Frames for Electric Motors

By ERNEST GARRETT

IN producing sheet-metal cylindrical frames or bodies for electric motors, the first operation consists of cutting the stock to length and piercing four 5/16-inch holes for wires that must enter the frame. The stock used for these motor frames is 3/16 inch thick and ranges from 4 to 7 inches in width for the various sizes.

The operation of the die shown in Fig. 1, which is used for rolling up or forming the flat blanks into cylinders, is simple. The stock *W* is placed on the top face of the closing jaws *A* between the guide blocks *B* and *C*, so that it is located against the fixed stop *D*. As the ram of the press descends, the forming die *E* bends the stock and carries it downward until it strikes the anvil *F*. The jaws *A* are then forced in by the heavy closing brackets *G*. As the ram continues its downward movement, the upper anvil *I* closes in the ends of the stock, forming it into a cylindrical tube, as shown at *W*, Fig. 2.

On the return stroke of the press, the forming die *E* is held against the lower anvil by the pressure of the springs *J* until the special nuts *K* on the guide rods *L* come in contact with the bracket *M* and carry it upward ready for the next stroke. As soon as the closing brackets *G* leave the sliding blocks *N*, attached to closing jaws *A*, a powerful spring at *P*, in the center of the lower anvil, forces the jaws apart and allows the nuts *K* to lift the bracket *M* mounted between the guide rods. The operator can then easily slide the stock off the die *E*, making it ready for the next piece.

In designing a die in which high stresses will be developed, the most severe conditions under which the die will be called upon to operate must be considered. We must be sure that the center of the forming die *E* is below the top face of jaws *A* before they start to close. The dotted lines at *O* show the position of die *E* when the bending of a blank 3/16 by 7 inches has been partly completed. This theoretical position was determined by assuming that the stock does not bend until the maximum load is imposed, through the pressure of the springs, exceeding the ultimate fiber stress in the stock. However, the actual position of die *E* is below this theoretical position, so we are certainly on the safe side.

Selecting suitable springs *J* proved to be an interesting part of the design work. It was necessary not only to have enough pressure to bend the stock, but also to have a travel of sufficient length to close the member *I* over the ends of the stock, in order to complete the forming operation. It was first neces-

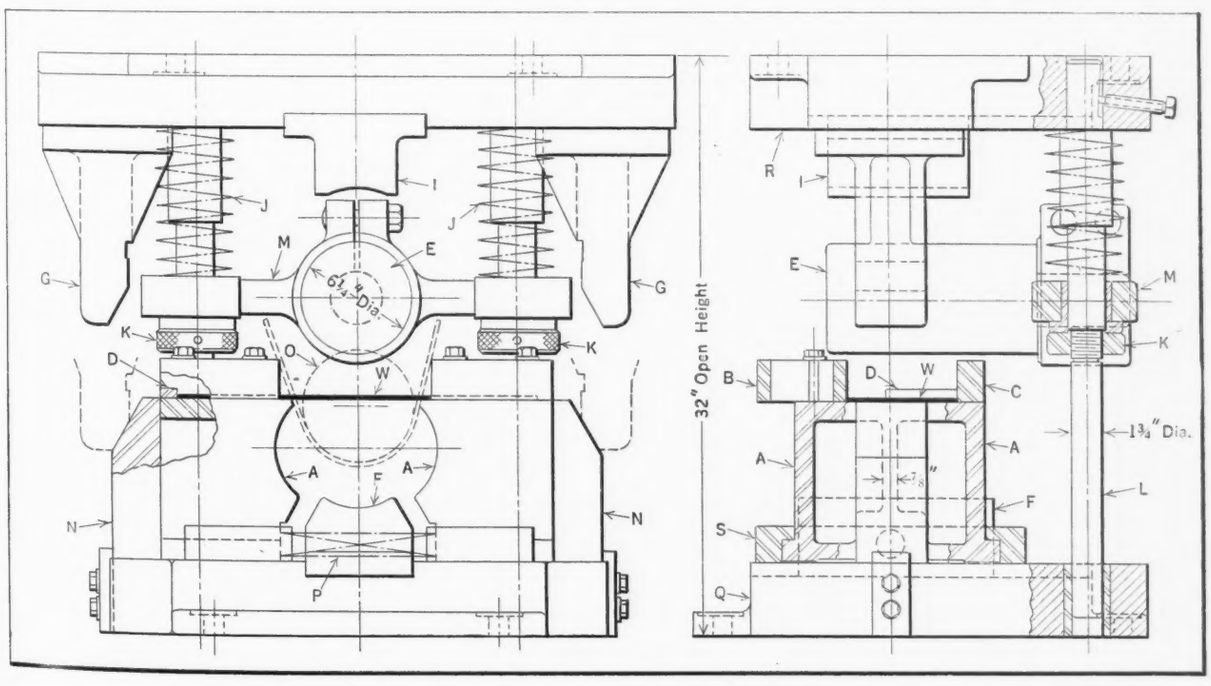


Fig. 1. Die Designed for Forming Flat Sheet-metal Blanks into Cylindrical Frames for Electric Motors

sary to determine the load required to bend the stock. The stock to be bent was treated as a simple beam resting on supports 7 1/8 inches apart. This dimension was obtained by scaling the distance between the jaws in the open position on a full-size layout.

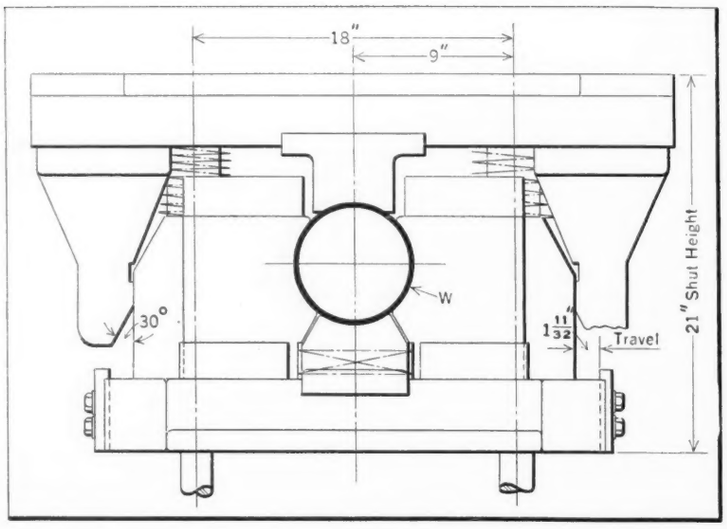


Fig. 2. Closed Position of Die Illustrated in Fig. 1, Showing the Work W Formed to Cylindrical Shape

The following formula for determining the maximum stress at the center of a beam of constant cross-section supported at both ends with the load at the center, as given in the eighth edition of MACHINERY'S HANDBOOK, page 376, was used in selecting suitable springs *J* and *P*:

$$\text{Stress} = \frac{Wl}{4Z}$$

where

W = load at center of beam;

l = length of beam; and

Z = section modulus of the cross-section of the beam as given in MACHINERY'S HANDBOOK on page 344, in which $b = 7$ inches and $d = 3/16$ inch.

To bend or roll up the stock as required, necessitates exerting a pressure in excess of the elastic limit of the material. Assuming that the ultimate fiber stress is 60,000 pounds per square inch and substituting the numerical values in the formula $\text{Stress} = \frac{Wl}{4Z}$, we have, $W = 1400$ pounds, approx.

This means that each spring must be under a tension of 700 pounds when bending stock 3/16 by 7 inches wide. By scaling the drawings with the dies in the open and closed positions, it was found that the free length must be between 8 and 9 inches; the shut height was found to be 5 inches; the remaining movement or travel required to close the ends of the stock was determined by trial.

In each trial it was necessary to find out how much the given spring would deflect under the 700-pound load. The formula for this deflection was also found in MACHINERY'S HANDBOOK. The springs chosen from the table in the HANDBOOK on page 466 have the following specifications: Outside diameter, 4 1/4 inches; diameter of stock, 5/8 inch; shut height, 5 inches; free length, 8.350 inches, plus or minus 1/32 inch; maximum fiber stress, 80,000 pounds per square inch; load required to compress spring to height of 5 inches, 2100 pounds. The choice of spring *P* was also determined from the same tables.

It is necessary to have a greater tension in the spring when the jaws are fully open than is required to overcome the sliding friction of the closing jaws. Although these jaws are cored, they weigh approximately 145 pounds each and require a force of 35 pounds to push them over a lubricated surface. The spring chosen for this work has the following specifications: Outside diameter, 1 3/4 inches; diameter of stock, 1/4 inch; shut height, 6 inches; free length, 10.320 plus or minus 1/32 inch; maximum fiber stress, 80,000 pounds per square inch; load required to compress spring to height of 6 inches, 328 pounds.

These springs were purchased from a manufacturer to suit the specifications given. Some of the features of this design are as follows:

1. The closing jaws were cored out to make them lighter. A 7/8-inch web is placed in the center to support the sliding block, as shown in the view to the right, Fig. 1. The bottom face of the casting is relieved so that there is less surface to machine and lubricate. This face also has oil-grooves designed to keep the surface well lubricated. Oil-holes are provided both in the jaws and guide blocks.

2. The closing brackets *G* are positioned well over the sliding blocks *N* before the upper anvil comes in contact with the stock. These brackets also serve to lock the jaws in position while the upper anvil is closing in the ends of the stock.

3. The guide block *B* is easily adjusted to take various widths of stock. The guide blocks were given sufficient depth to insure proper alignment while bending, as shown by dotted lines in Fig. 1.

4. By inserting the anvils in machined recesses in the lower and upper members *Q* and *R*, it is a simple matter to assemble the die with the assurance that all parts will be in accurate alignment.

5. If, for any reason, the thickness of the stock or the diameter of the motor frame is to be changed, it is a simple matter to remove members *E* and *A* without taking the whole die apart.

6. The guide rods *L* of the die do triple duty: First, they keep the upper and lower halves in proper alignment; second, they carry the forming die proper and allow it to float up and down; they also take the thrust of the bending stresses on the downward stroke of the press; and third, they serve to house the springs.

The Shop Executive and His Problems

Superintendents and Foremen are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

A SUCCESSFUL series of meetings is being held by the foremen of the S. L. Allen & Co., Inc., Philadelphia, Pa. The meetings are held once a week at noon time, using one-half of the men's time and one-half of the firm's. The firm believes that what you get out of a thing is measured by what you put into it, and aids in creating a congenial spirit by supplying cigars and cigarettes.

The superintendent regularly attends these meetings. Current problems are brought up for discussion, which the group often solves to the advantage of all concerned. One foreman acts as secretary and takes notes as each man, in turn, tells of some situation with which he has had to contend or which may confront him at the time. The subject is commented upon and suggestions made by the rest of the group. This method encourages a free exchange of ideas, creates cooperation, and promotes better coordination of the work in the plant.

JAMES H. PARTRIDGE

Keeping Salesmen Waiting

Referring to the article in December MACHINERY, page 232, on the subject of keeping salesmen waiting, the writer observed in a well-known plant in Worcester, Mass., the following announcement in the waiting room for visitors:

"If you are kept waiting longer than ten minutes, find out why.—The Management."

The management of a plant that takes this interest in visiting salesmen and others who may have business to transact at the plant, is to be commended. If this practice became general throughout the country, an enormous amount of time could be saved.

OBSERVER

An Englishman Commends Flanders' Letter to the President

Although an Englishman's opinion in this case may be of little value, I would like to express my appreciation of the splendid letter from the National Machine Tool Builders' Association to the President of the United States which you published in December MACHINERY, page 225, under the heading "The Mechanical Industry Speaks to the President."

Blaming industry and mainly the engineers for the world depression is, unfortunately, very prevalent in most countries, including Great Britain. I do not blame people in general for these views, as they cannot know the true facts, but it is surprising how many prominent men fall for this misconception; and, having fallen for it, try to lead us back to stone-age conditions.

Luckily there are others, both in Great Britain and in your country, who see the real obstacles to progress and will persist in striving to give to the millions some of those pleasures now enjoyed by the few.

The letter written by Mr. Flanders on behalf of the National Machine Tool Builders' Association to the President is a marvel of clear thinking, ringing with loyalty and courage. Your President is to be congratulated, because with such men at his command, National Recovery will be assured.

T. S. CATMUR, Managing Director
Catmur Machine Tool Corporation Ltd.
London, England

A Code for Labor as well as for Industry

Every person who gives any thought to the subject realizes that the consuming power of that great body of people generally classed together as labor is the backbone of our industrial structure, and that good wages, enabling labor to purchase and consume the products, in the making of which labor has so important a part, is highly desirable.

A somewhat similar statement might, with equal truth, be made of some of our largest industrial corporations, who are also great consumers of goods and creators of products that add to the convenience and comforts of life. Now, these great industrial organizations have to submit to being regulated by codes approved by the Government. Why should not organized labor, which possesses a power far greater than that of any industrial corporation, also be expected to be governed by a code setting forth what such an organization may or may not do, and defining definitely and clearly methods that may be labeled unfair practices?

All progress is made effective through organization, and no one can take exception to organizations of labor any more than to organizations of manufacturers or of engineers; but if the latter groups are to be governed by codes of conduct, supervised through governmental agencies, why not labor?

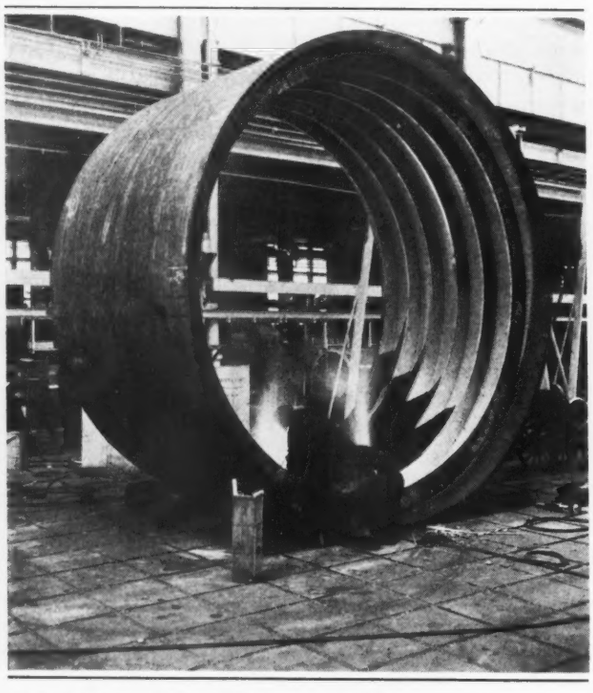
A READER

Notes and Comment on Engineering Topics

A new instrument for testing the dielectric strength or insulating value of sheet materials such as plain paper, gummed or varnished paper, cloth, varnished cambric, rubber, mica, and other insulating materials, as well as for testing complete units, such as transformers, coils, and insulated wire, has been developed by the Sound Engineering Corporation, 416 N. Leavitt St., Chicago, Ill. This development is of particular interest, as there has previously been no device on the market for making such tests with laboratory accuracy, coupled with convenience and safety. The instrument is completely self-contained and enclosed in a metal case. It can be carried around conveniently, its weight being 65 pounds.

The so-called "trackless trolley"—a street car or bus that does not run on rails but obtains its power from an overhead electric wire—is gaining ground. The Indianapolis Railways recently purchased eighty such trackless-trolley cars.

A 1000-horsepower motor that can be brought from full speed to a dead stop in 1 1/4 seconds (or in 3 1/2 revolutions) has been built by the Westinghouse Electric & Mfg. Co. for the Goodyear Tire & Rubber Co., at Akron, Ohio. The motor will be used for driving the huge rolls used in rubber mills, each 7 feet long and more than 2 feet in diameter. By the use of this motor, these mills can be stopped almost instantly; in fact, the surface on the rolls travels only 9 inches after the current has been shut off. The stopping switch is a continuous strip, shoulder high, running the length of the mill. An operator can stop the mill by touching the switch with his head, shoulder, or free arm.

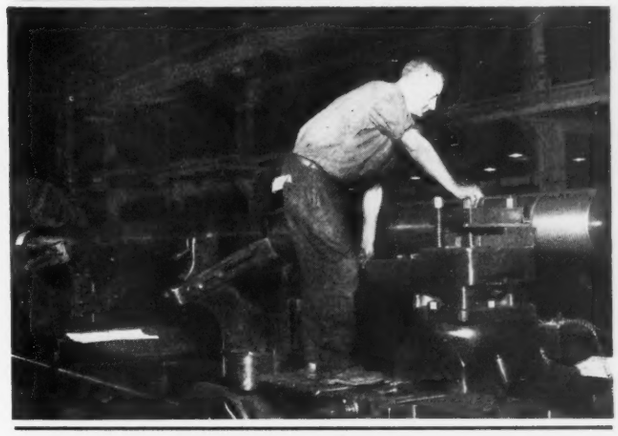


Stiffening Rings Being Arc-welded to the Shell of Half of One of the Two Main Hoist Drums for the 150-ton Permanent Cableway for the Boulder Dam — Photograph, Courtesy General Electric Co.

Diesel-electric railway cars for high-speed express service have been given a thorough trial in England on the London, Midland & Scottish Railway. The trial runs have been made between London and Birmingham. Speeds of seventy miles an hour were attained on several occasions and an average speed of over sixty miles an hour was maintained for the better part of the trip with a 250-horsepower engine. The fuel consumption was approximately one cent a mile. Beyond a doubt, there is a great future for high-speed, small-unit, Diesel-electric cars and trains.

The total number of motor buses in the United States is 105,000, of which 45,000 are used in transportation for revenue. Apart from buses so used, the largest use of buses is for the transportation of school children, nearly 60,000 buses being used in this service.

According to *Industrial Britain*, the Unislip Propeller Co., Milburn House, Newcastle-on-Tyne, England, has, after many years of experiment and research, developed a new type of marine propeller that introduces great changes in past marine pro-



Machining a Nickel-molybdenum Steel Bolt Weighing 6 Tons. This Bolt which is 13 Inches in Diameter and 26 Feet Long—the Largest of Its Kind Ever Made—Helps to Hold Together the 5-foot Diameter Metal Disks of the Rotor for the Philadelphia Electric Co.'s New 250,000 Horsepower Turbo-generator Now being Built in the Westinghouse Works

pulsion and is expected to exert a considerable influence upon future shipbuilding and marine engineering. The propeller consists of a number of blades arranged in pairs so that one blade acts as a primary blade and the other picks up the flow of water past the primary blade. Operating under similar conditions and with equivalent fuel consumption, this propeller has shown an improvement of 20 per cent in efficiency over the ordinary type of propeller in fine weather, and even more than this in bad weather.

Rivets and bands in corrugated metal roofing have been avoided by the use of electric welding in constructing a roof at the plant of the Republic Carbon Co., Niagara Falls, N. Y. The roof was welded from the Republic Steel Corporation's Toncan iron, this material being selected because of its resistance to corrosion and acid. Overlapping expansion joints were placed at intervals of 28 feet. Such a welded all-metal roof presents no crevices under which the wind can obtain sufficient leverage to rip off sheets; likewise, water cannot be driven by the wind between the sheets.

Cloth that has all the appearance of glass on the surface is the latest product of the Lancashire textile industry, according to *Industrial Britain*. It is stated that designs in colored glass can be applied without laborious handwork to velvet, silk, lace, and cotton fabrics. The experiments, which have been carried on for some time, have now reached the stage that justifies actual manufacture. It is further stated that the new cloth can be washed and ironed without damage to the design in synthetic glass incorporated in it.

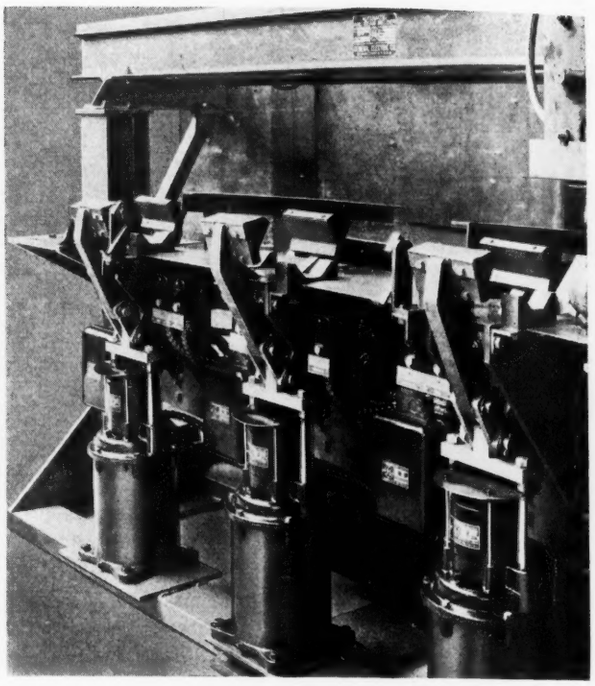
According to Robert C. Stanley, president of the International Nickel Co. of Canada, Ltd., the world consumption of nickel in all forms for the first ten months of 1933 was approximately 77,600,000 pounds, as compared with slightly more than 49,500,000 pounds in the same period of 1932. The peak year of nickel consumption was 1929, when 112,500,000 pounds were consumed in the first ten months.

Great Britain's first streamline rail car has been introduced by the Great Western Railway on one of its suburban services. The car, which is described as having an appearance something like a seaplane float, is 62 feet long, weighs 20 tons, and is designed for a maximum speed of 60 miles per hour, with seating capacity for sixty-nine passengers. The sides of the car extend to within one foot of the track, so that practically the whole vehicle, including the wheels, is enclosed in a streamline case. Everything possible has been enclosed, even to the head and tail lamps, which are fitted flush with the case. The effect of this streamlining has been to reduce the power required to drive the car against wind resistance at 60 miles an hour to one-fifth of that required by a similar square-ended car.

A new photoflash lamp that gives more light for its size than any light source in existence today and is designed especially for amateur use, where it is expected to open up new picture-taking possibilities, has been developed by the Incandescent Lamp department of the General Electric Co. at Nela Park, Cleveland. Although its bulb size is only that of an ordinary 40-watt lamp, this new photoflash lamp has a peak light output of 2,500,000 lumens—one-half that of the larger size photoflash lamp. As in the larger lamp, the new bulb contains a quantity of extremely fine aluminum foil crumpled around a 1.5 volt filament. The remainder of the bulb is filled with pure oxygen, and it is the rapid burning of the foil which causes the tremendous light output. The noiseless, smokeless flash emitted is sufficiently fast—1/50 second—to catch natural expressions and give life-like action pictures.

How the Thrustor Solves Designing Problems

The Straight-Line Movement Imparted by This Device Provides a Simple and Effective Means of Operating Machines and Mechanisms



General Electric Automatic Arc Seam Welder for Automobile Rear-axle Housing Tubes, Equipped with Thrustor Clamping Mechanism

THE compact self-contained Thrustor unit is designed to impart a straight-line motion to a cross-head connected to the mechanism to be operated. The manner in which this straight-line motion is obtained hydraulically from the rotary motion of an electric motor was described in March MACHINERY, page 442. It is the object of the present article to show how this recently developed device can be used to operate a variety of machines and mechanisms.

The essential parts of the device are the motor, radial-blade centrifugal pump, piston, push-rods, cross-heads, top clevis, bottom clevis, oil, and oil tank. These parts are assembled into a compact unit which can be applied in many ways, typical examples of which are shown diagrammatically in Figs. 1 to 36. The Thrustor device is a development of the General Electric Co.'s, and is regularly made in several sizes, varying in stroke from 2 to 8 inches and in thrusting pressure from 50 to 3200 pounds.

The oil pressures for operating the device are low, ranging from 5 to 25 pounds per square inch. The construction is such as to require no packing glands or stuffing-boxes under pressure. This minimizes oil leakage. Although primarily designed for operation in a vertical position to avoid the use of stuffing-boxes or packing glands under pressure, some latitude in mounting is permitted. The smallest size, for example, will operate for its full maximum stroke when tilted at an angle of 45 degrees, while other sizes cannot be tilted to an angle over 20 degrees without considerable reduction in the length of stroke. In general, it is preferable to mount the Thrustor device in a vertical position and change the direction of movement by a lever system, wire ropes and pulleys, or by other means, such as illustrated by the accompanying diagrams.

By using suitable stops, the length of stroke can be controlled to meet the requirements. Before incorporating a Thrustor device in the design of a machine, it is well to check over the following questions: (1) Are dust, moisture, chemical fumes, temperature, or other atmospheric conditions such that it will run successfully? (2) Is the time cycle such that heating will be within its capacity? (3) Is the time required for the up stroke or the down stroke, or both, such that it will meet requirements? (4) Is the work to be done within the capacity of a Thrustor device of standard size?

When the device works against a friction load in opening a door or gate, the required pressure can be determined by a spring balance applied at the point to which the Thrustor device is to be connected. The distance through which this point moves can be measured and the pressure in inch-pounds determined.

As it is designed for mounting at only a moderate angle from the vertical position, it often becomes necessary to change the vertical motion to a horizontal plane or a plane at some other angle. Simple levers, either straight or of the bellcrank type, are widely used for this purpose. Wire ropes with pulleys for changing the direction and two-diameter drums for changing the length of stroke can often be used when a lever system would be too complicated.

Toggle joints can be used to obtain a comparatively short stroke and very high pressure. A rack and pinion can be used to good advantage for converting a straight-line motion to a rotary motion. The efficiency of these motion transformer mechanisms must, of course, be taken into consideration

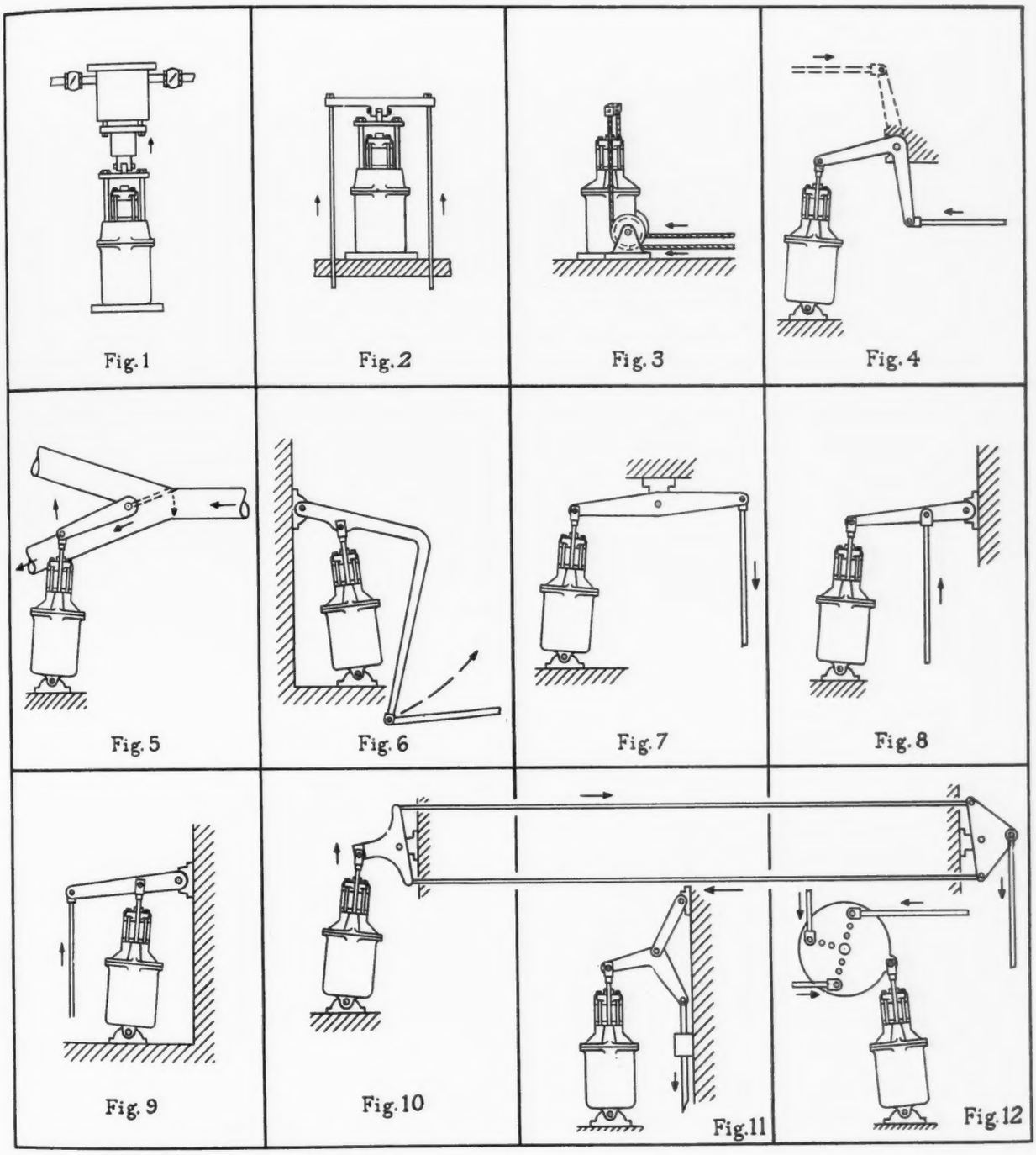


Fig. 1. Straight Push-up (Die-casting Machines, Pumps). Fig. 2. Straight Pull-up (Pit Covers, Furnace Doors). Fig. 3. Horizontal Pull (Hopper Trips). Fig. 4. Bellcrank Used to Change Direction of Thrust where Thrustor Cannot be Placed Close to Work. Fig. 5. Limited Rotary Motion (Dumpers, Gates, Deflectors, Draft and Flue Gas Control). Fig. 6. Multiplying Bellcrank Changes Direction and Increases Motion with Reduced Thrust (Dumper, Conveyor Loader or Unloader). Fig. 7. Lever Reverses Direction and May Change Stroke and Thrust (Gate or Valve on Floor Below). Fig. 8. Lever Reduces Stroke and Increases Thrust, Same Direction (Heavy Lift as on Friction Clutch). Fig. 9. Lever Increases Stroke and Reduces Thrust, Same Direction (Conveyor Deflector). Fig. 10. Transfer Motion to Distant Point that May be Inaccessible or Unsafe for Thrustor (Control in Explosive Gases or in Hot Flues). Fig. 11. Bellcrank and Toggle Gradually Increases Thrust to a High Intensity (Embossing Press, Extruder, Die-caster). Fig. 12. Trammel Plate Divides Effort and Changes Direction. Holes Allow for Adjustment (Batch Mixing, Multiple Valve Operation)

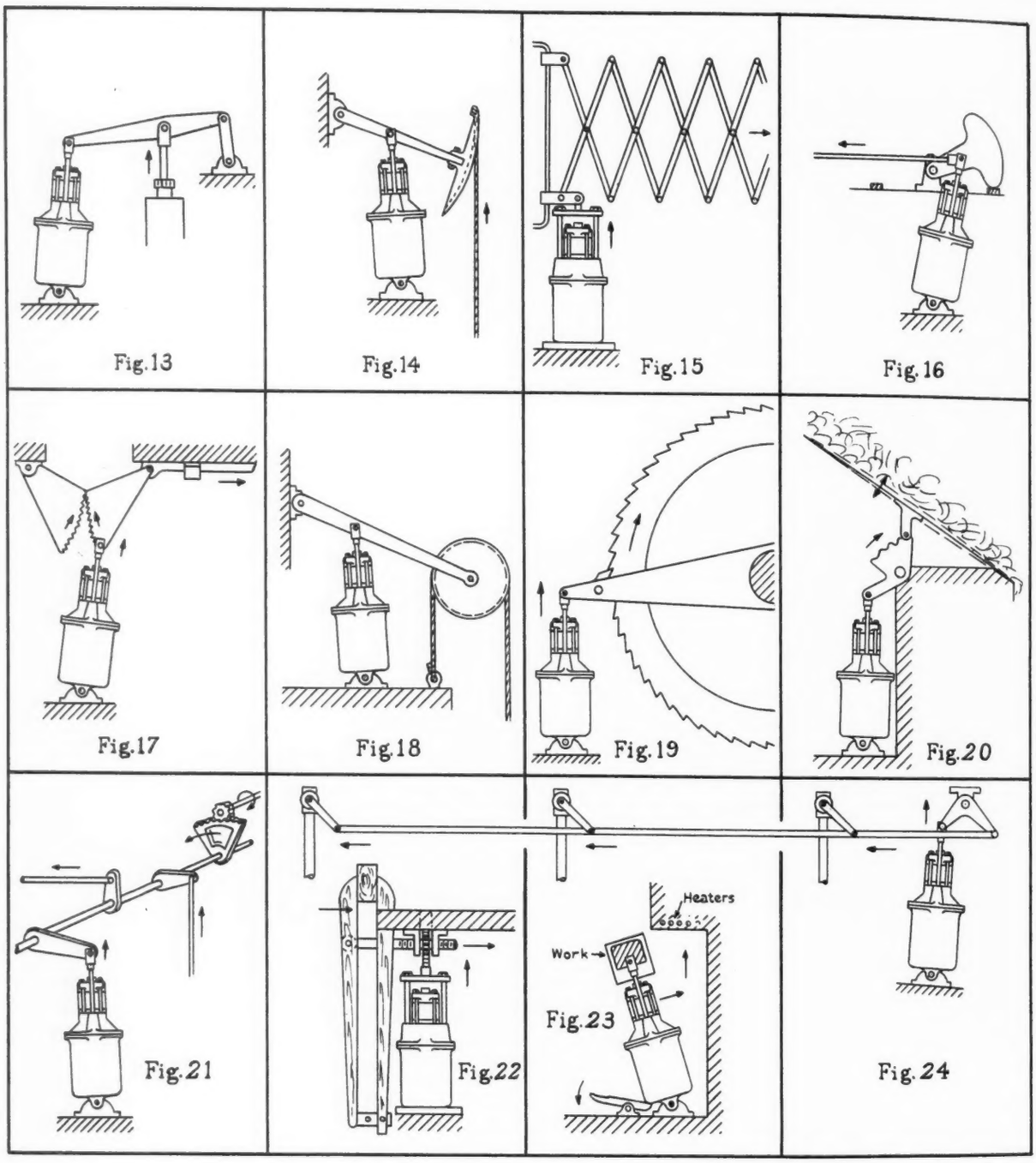


Fig. 13. Reduced Straight-line Thrust (Pump or Valve Steam or Hydraulic Device for Remote Application). Fig. 14. Straight-line Motion Reversed and Multiplied (Furnace Door). Fig. 15. Lazy Tongs, Great Multiplication of Motion at Right Angles (Elevator Guard Gate or Gate Operated from Watchman's House). Fig. 16. Double Throw by Momentary Applications. Thrustor De-energized except when Throwing Weight Over (Open Row of Windows in Morning, Close Them at Night). Fig. 17. Constant-thrust Toggle (Brake Mechanism—Applies Same Pressure until Shoes are All Worn Out). Fig. 18. Multiplying and Reversing Motion, 6:1 Ratio (Screen Shift, Rolling Device for Production Operation). Fig. 19. Engine Barring. Erector can Carry Push-button on Flexible Cable and Inch Engine Along as he Assembles and Adjusts Gear. Fig. 20. Chute Vibrator. Up and Back Once for Each Batch, Insures Emptying Hopper and Supplying Uniform Batches. Fig. 21. Lay Shaft Divides Work among Several Chores (Open One Gate, Close Another, Open Valve). Fig. 22. Quick-acting Rise on Production Work. Operator Uses Both Hands for Work and Clamps and Releases with Foot Push-button. Fig. 23. Quick-acting Press. Glues Label on Hot Surface. Fig. 24. Shipper Rod for Multiple Operation of Valves

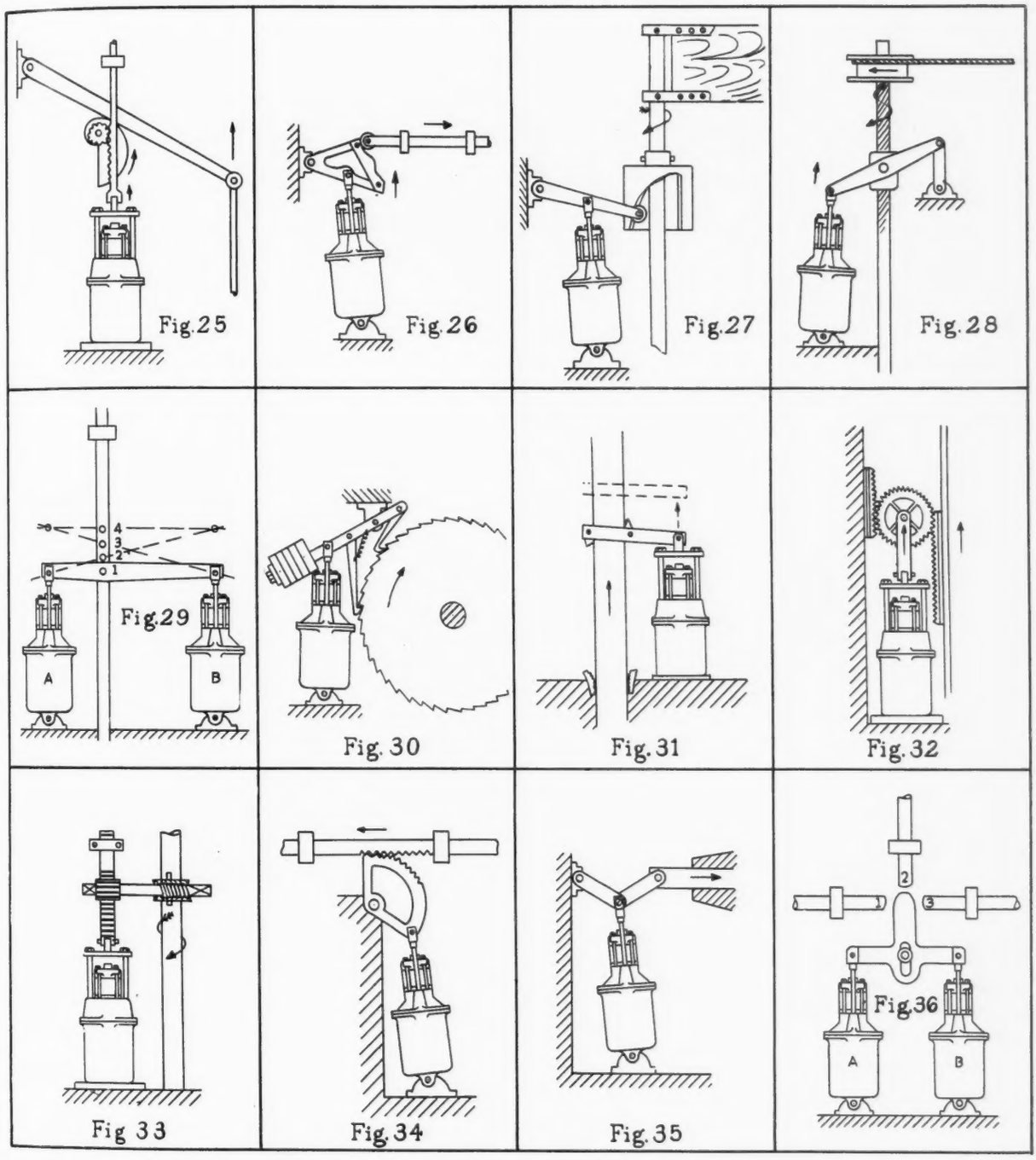
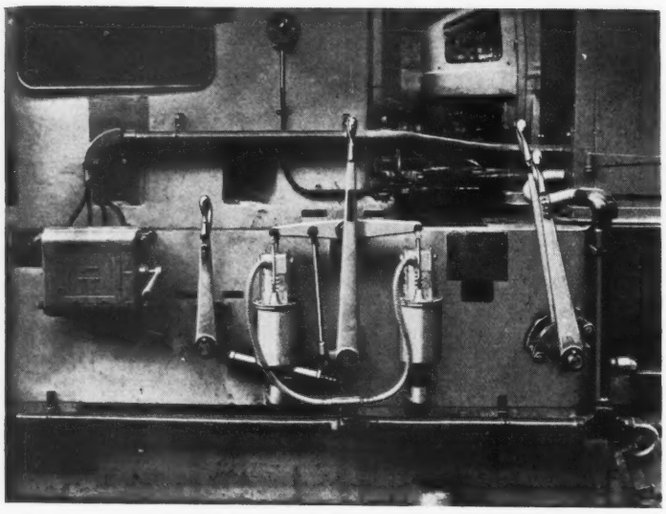


Fig. 25. Graduated Motion by Cam. Similar to Steam Engine Valve Motion. Slow Motion at Start, Fast Finish. Fig. 26. Thrust Motions and "Dwells" Regulated by Shape of Cam. Moves One Part of Machine, Waits for Second Part to Act, then Completes Setting. Fig. 27. Rotary Motion with Cylindrical Cam (Operator's Gate across Conveyor to Any of a Number of Hoppers). Fig. 28. Fast Rotary Motion (Long Stroke or Valve Opening, Feed for Automatic Machine, Barrier Hoist). Fig. 29. Four Positive Positions with Two Thrustors—No. 1, Both Down; No. 2, B Up; No. 3, B Down and A Up; No. 4, Both Up (Damper Position Between Kiln and Stack in Cement Plant. Switch Position on Conveyor System). Fig. 30. Rotary Motion (Forge Blower with Belt Drive—Can Operate Switch Automatically. Rotate "Station" Production Machine). Fig. 31. Intermittent Lift (Pipe Lift from Well). Fig. 32. Straight-line Motion Multiplied (Long Stroke Single-stroke Pump). Fig. 33. Powerful Rotary Motion (Gas Producer Poker). Fig. 34. Straight-line Motion Horizontal (Door Opener). Fig. 35. Horizontal Motion Intensified (Coin Press). Fig. 36. Thrusts in Three Directions with Two Thrustors—No. 1, B; No. 2, A and B; No. 3, A (Equipment Operates Two Clutches and an Unloader)



Boring Machine that is Equipped with Thrustor Units to Control Clutch for Forward or Reverse Feed

in calculating the size of Thrustor unit required.

Although Thrustor apparatus cannot be considered quiet, particularly when motors of the single-phase and direct-current types are used, on account of the high speed at which they run, the three-phase type operates the most quietly and it will often be acceptable, unless it is essential that there be no noise. However, care should be taken when planning applications in such buildings as clubs, hospitals, and hotels, to make the installation as quiet as possible by suitable foundations and acoustic treatment of the room in which the machinery is housed.

Thrustor devices up to the 150-pound size for either alternating or direct current can be controlled directly with push-buttons. The motors of the larger units have too high an inrush current to be started directly on a push-button. Consequently, suitable control, either manual or magnetic, must be selected if the Thrustor is not energized from the control of the machine to which it is connected.

If it is desired that the Thrustor device operate only when an attendant keeps the circuit closed, a single-button switch can be used or, as a safety measure, two button switches may be connected in series so that both of the attendant's hands will be removed from the danger zone. In such cases, the holding circuit interlock of the magnetic switch is disconnected. When the device is required to remain energized for some time without attention, the use of a "stop-start" push-button station is necessary. When a cycle of operations must be repeated for an indefinite time, switches can be provided that open and close at each end of the piston stroke.

Anti-Friction Bearings Used One Hundred Years Ago

"An Outline of History of Anti-friction Bearings" is the name of a booklet recently published by the Fafnir Bearing Co., New Britain, Conn. In this booklet it is pointed out that ball bearings were employed nearly a hundred years ago in the capstan in the lock operating mechanism of the Morris Canal, New Jersey. The balls in these bearings were made of cast iron and were 9 inches in diameter.

As early as 1870, we find several railroads using roller bearings. Roller-bearing car axles were used in Ohio at that time, and the Spencer roller bearing was employed on at least two other railroads during that period. By 1890, the Delaware & Hudson Railroad used roller bearings very extensively, and the Boston & Albany Railroad also used them.

The first patent granted by the United States Patent Office for an anti-friction bearing was of the roller type. It was applied to a grindstone. The patent was issued just a hundred years ago—in 1833. Since then more than 1700 patents have been issued on ball and roller bearings. It was not until the advent of the bicycle, however, that ball bearings became more generally used. At the height of the bicycle fad in the nineties, there were at least seven companies making balls for ball bearings.

Probably the greatest debt the ball-bearing industry owes Germany is for Dr. Stribeck's investigations. In 1896, Dr. Stribeck engaged in a comprehensive study of the properties of balls and bearings. This investigation, which covered a period of several years, made it possible to design and make ball bearings of a better type than those formerly employed. Shortly afterward, the automobile came into general use; and to a certain extent it may well be said that anti-friction bearings made the motor car possible, while, on the other hand, the motor car has built up the anti-friction bearing industry to its present huge proportions.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Mechanism for Removing Incompletely Assembled Caps from Conveyor Wheel

By JOSEPH WAITKUS

Cork disks *S*, Figs. 1 and 2, are assembled in caps *W* by automatic machinery having a conveyor or transport wheel *A*. Occasionally, the mechanism for feeding the cork disks into position for assembling becomes jammed, with the result that caps *W* pass to the ring *B* of the transport wheel *A* unprepared for the operations that are to follow.

The automatic assorter or mechanism shown in Fig. 1 for removing the caps that fail to receive cork disks was developed after some experimental work and attached to the transport wheel. This self-contained mechanism prevents the incompletely assembled caps from continuing along the line and thus causing unnecessary expense for useless work. The assorting device operates satisfactorily and performs the desired sorting operation at a point that could not be reached readily by the operator's hand. The principle is simple and should be easily adaptable to other work of a similar nature.

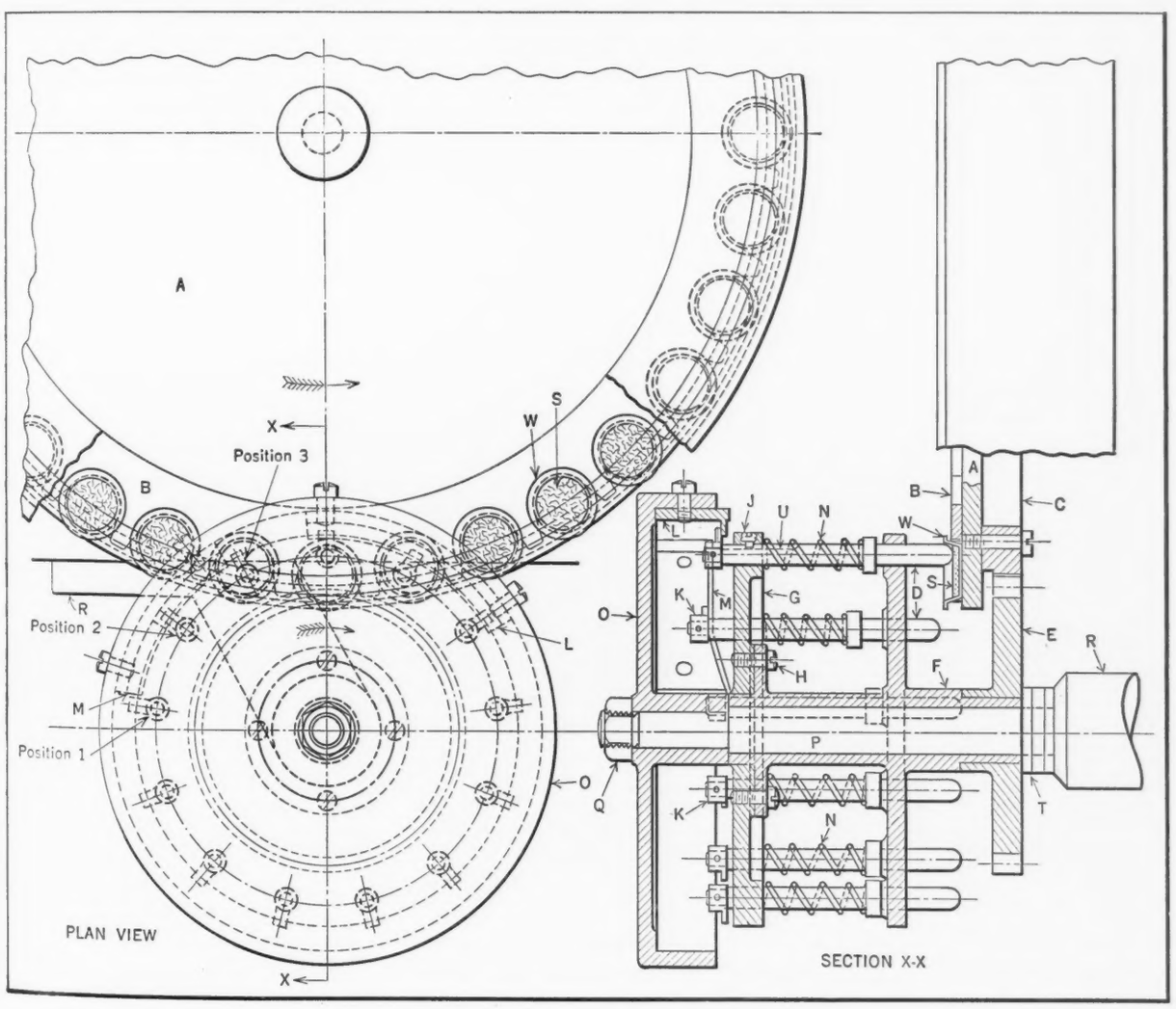


Fig. 1. Mechanism that Automatically Removes Caps W from Transport Wheel A when the Disk-feeder Fails to Supply the Caps with Cork Disks S

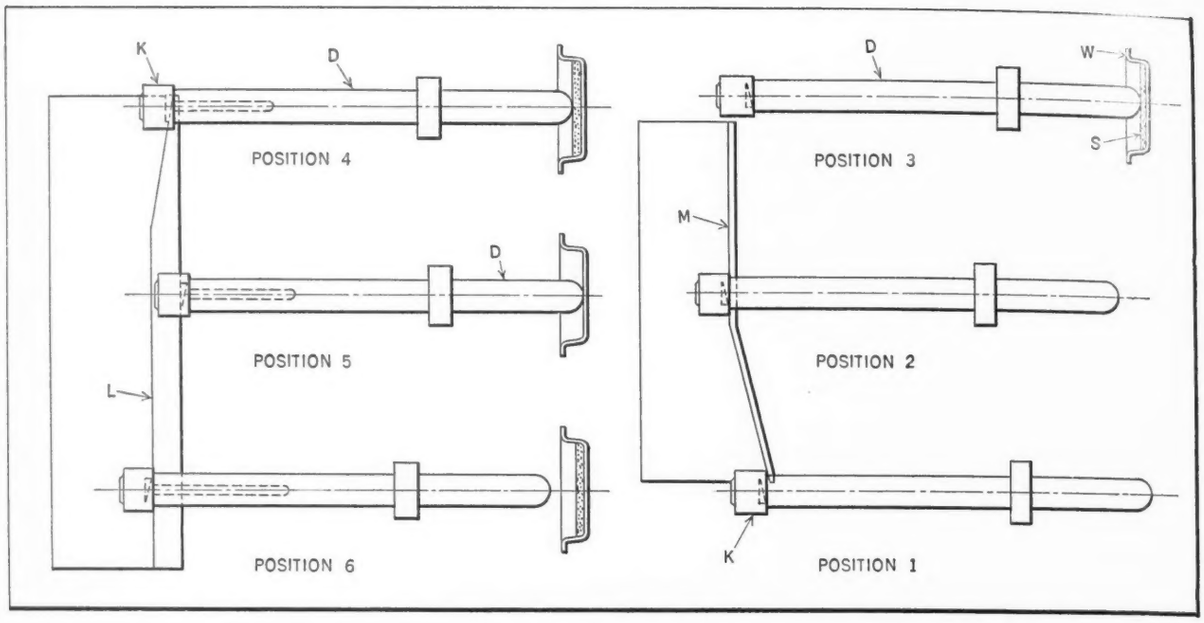


Fig. 2. Diagrams Illustrating Principle Employed in Mechanism for Removing Caps W from Machine when the Feeding Device Fails to Supply Them with Cork Disks S

Ring *B* is fastened to disk *A*, the caps *W* being carried in machined recesses provided in ring *B*. The ring-gear *C* is attached to the bottom of disk *A*, and through its connection with the gear *E*, serves to actuate the automatic assorter. Gear *E* is fastened to the flange member *F*, which is part of a spool consisting of two flange members *F* and *G*, held together by screws *H*. The spool rests on the thrust bearing *T* and revolves on the spindle *P*, which is part of the stationary support *R*.

Holes are drilled and reamed in the flanges *F* and *G* to permit a sliding fit for the plungers *D*. In order to prevent the plungers from twisting in their bearings, a slot *U* is provided in each one in which a set-screw *J* acts as a key. A light spring *N* keeps the plungers down. Each plunger is equipped with a lifter *K*, pinned in place at its upper end. The combined cover and cam-holder *O* is held in position on spindle *P* by the nut *Q*. Two cams *L* and *M* are fastened to the cam-holder *O*.

In operation, the movements of plungers *D* are controlled by cams *L* and *M*. The position of the first cam *M* is shown in the view to the left, Fig. 1. In Position 1, Fig. 2, the lifter *K* is shown making its initial contact with the cam surface. Position 2 shows the plunger resting so as to clear the cap entirely. In Position 3 the plunger is shown released and dropped into the cap under the action of spring *N*, Fig. 1. Positions 1, 2, and 3, Fig. 2, correspond to the points marked 1, 2, and 3 in Fig. 1.

The function performed by cam *L* is illustrated in the views to the left, Fig. 2. In Position 4, plunger *D* is shown resting on top of a cork disk inserted in the cap. The lifter *K*, in this case, is raised high enough to permit it to make contact with the cam surface. In Position 5, plunger *D* is shown resting on the bottom of a cap, with no cork disk in place. In this case, the lifter *K* is positioned too low to make contact with the cam surface, so that it passes under cam *L*. Since the plunger is not raised out of the cap in the latter case, it causes the cap to be removed from its position in the transport wheel by the plunger *D*. In Position 4, however, the cap moves on, because the plunger is raised sufficiently to allow the cap to retain its position in the transport wheel.

This device can be operated successfully at relatively high rates of production. In increasing the operating speed, it becomes necessary to place cams *L* and *M* farther apart, in order to give plunger *D* time to drop into the cap before the lifter *K* makes contact with cam *L*. The space between the plungers on the automatic assorter should be equal to the distance between the caps on the transport wheel.

Agitating Device for a Pin Hopper

By J. E. FENNO

Difficulty was experienced by a plant manufacturing electrical switches in maintaining a sufficient flow of switch pins from hopper to power press. The pins are made from brass rod and are about 3/16 inch in diameter by 3/8 inch long. The hopper is of simple design, consisting chiefly of a stationary conical shell in which the pins are placed. A length of tubing having an inside diameter slightly larger than the diameter of the pins is a slip fit in a vertical hole bored in the lower end of the hopper; this tubing is given a vertical movement, which is transmitted from the press crankshaft through a rack and pinion.

As the end of the tube passes through the pins, some of them drop into the tube and down to a

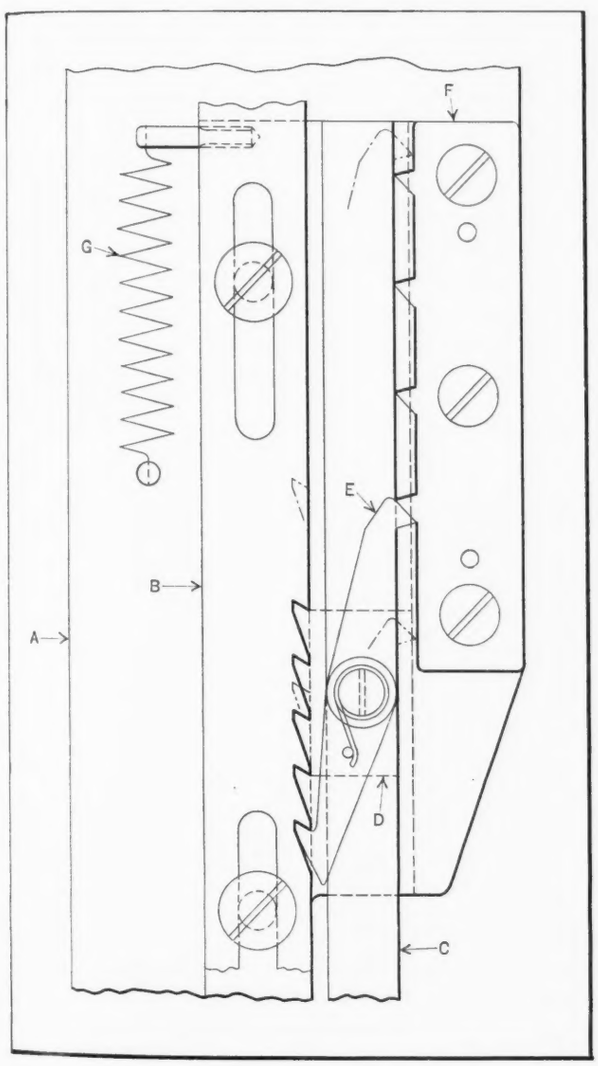
connecting chute, which carries them to the press. It was found, however, that the pins had a tendency to collect around the tube horizontally instead of vertically, so that the number entering the tubing during each stroke was insufficient to supply the press. After some experimenting, this difficulty was overcome by the use of an agitating device, as shown in the illustration.

Bracket *A* is stationary, the upper end (not shown) supporting the conical shell with its tube while the lower part carries the agitating device. The tube is secured to the sliding bar *B*, both parts being raised to the upper position by means of the reciprocating arm *C* pivoted to the cross-head *D*. A double-end latch *E* is also pivoted to the cross-head, and engages teeth cut in bar *B*, as well as projections on the plate *F*, which is secured to bracket *A*.

In the position shown, the cross-head has already started its upward stroke, carrying with it bar *B* and the tube. Further movement of the cross-head causes the upper end of the latch to be forced to the left by the lower projection on plate *F*. At the same time, the lower end of the latch is forced out of engagement with the lower tooth in bar *B* and allows the bar to drop back by gravity, aided by the action of coil spring *G*. The lower end of the latch is held away from the bar momentarily only; thus, as the upper end passes the projection on plate *F*, its lower end at once enters the next tooth space in the bar *B*, which then continues its upward movement until the latch engages the next projection on plate *F*. At this time, and for each remaining projection, the action described is repeated.

At the end of the upward stroke, bar *B* is held suspended by the latch, but upon starting its downward stroke, the latch again comes into contact with the upper projection on plate *F* and is released from the bar, allowing the latter to drop to its lowest position. Here the slide is picked up once more by the latch after the cross-head returns to the bottom of its stroke. Incidentally, a bumper (not shown) is provided to take the shock upon the return of bar *B*.

Obviously, a series of reciprocating movements is imparted to the tube as it passes upward through the pins, agitating them sufficiently to cause a greater number to enter the tube. It should be mentioned that the success of a device of this type depends upon the speed of the cross-head, because if the speed is too slow, the lower end of the latch will fail to catch the tooth in the sliding bar, thus rendering the device inoperative.



Device which Increases the Flow of Work from a Hopper by Imparting Short Reciprocating Movements to the Feeding Tube as it Passes through the Parts

* * *

Pension Plan to Aid in Maintaining Purchasing Power

The Kellogg Co. of Battle Creek, Mich., who, in December, 1930, inaugurated a six-hour working day, with four shifts in its factory, has recently established a pension plan for its employes, together with life, health, and accident insurance. All employes who have been with the company for one year are eligible to participate in the plan. The employes make monthly payments which are matched dollar for dollar by the company. In order to remove the pension and insurance features entirely from the business ventures of the company, the administration of the funds is handled by the Metropolitan Life Insurance Co., which company also underwrites the health and accident insurance.

In commenting upon the plan, W. K. Kellogg, founder and president of the company, stated that the pension plan "is designed to provide, even beyond the time of active work, a continuation of the individual's purchasing power. We believe, with many others, that the future of our country depends upon maintaining the purchasing power of the millions of wage and salary earners. Only such purchasing power can absorb the capacity of present industry production."

EDITORIAL COMMENT

The past year has seen many changes in our national life. As far as industry is concerned, one fact stands out more clearly than any other: American industry is organized as it has never been before. For years, many of the leaders in industry have looked forward to a time when the different branches of industry would be brought together in trade associations to consider their common problems with a view to the common good. A few industries have been so organized for years, but a great number of enterprises have not been affiliated with any group that could speak with authority for that particular industry; they have stood alone.

American Industry is Organized to Grapple with Its Problems

This has all been changed within a few months. Every important industrial group is now tied together in some kind of industrial organization, and common standards for the conduct of business for that group have been accepted. When the present emergency is over, industry will find itself in an excellent position to govern itself through its own organizations. It will be in a position to deal more effectively with all the common problems that may confront it. It can get a hearing at Washington when legislation affecting industry is pending; and organized industry can speak authoritatively for those engaged in it, presenting its problems, if need be, to the judgment of public opinion.

If there were no other results from the NRA than this thorough organization of industry into groups, capable of deciding for themselves the manner in which the industry should be conducted, its efforts would be well worth while. Some of the organizations formed may not continue to function in more normal times; but the great majority will, and the effect on the conditions in American industry cannot help but be of value both to industry and to the public welfare.

The idea that we can regain prosperity by courting inefficiency has, unfortunately, been accepted by many of our public officials. A manufacturer in the Middle West writes us about several road contracts, recently let, that specify that all handling of gravel must be done by hand shoveling and not by machinery. The more inefficient we are in doing our work, the sooner, presumably, is prosperity to return to our midst.

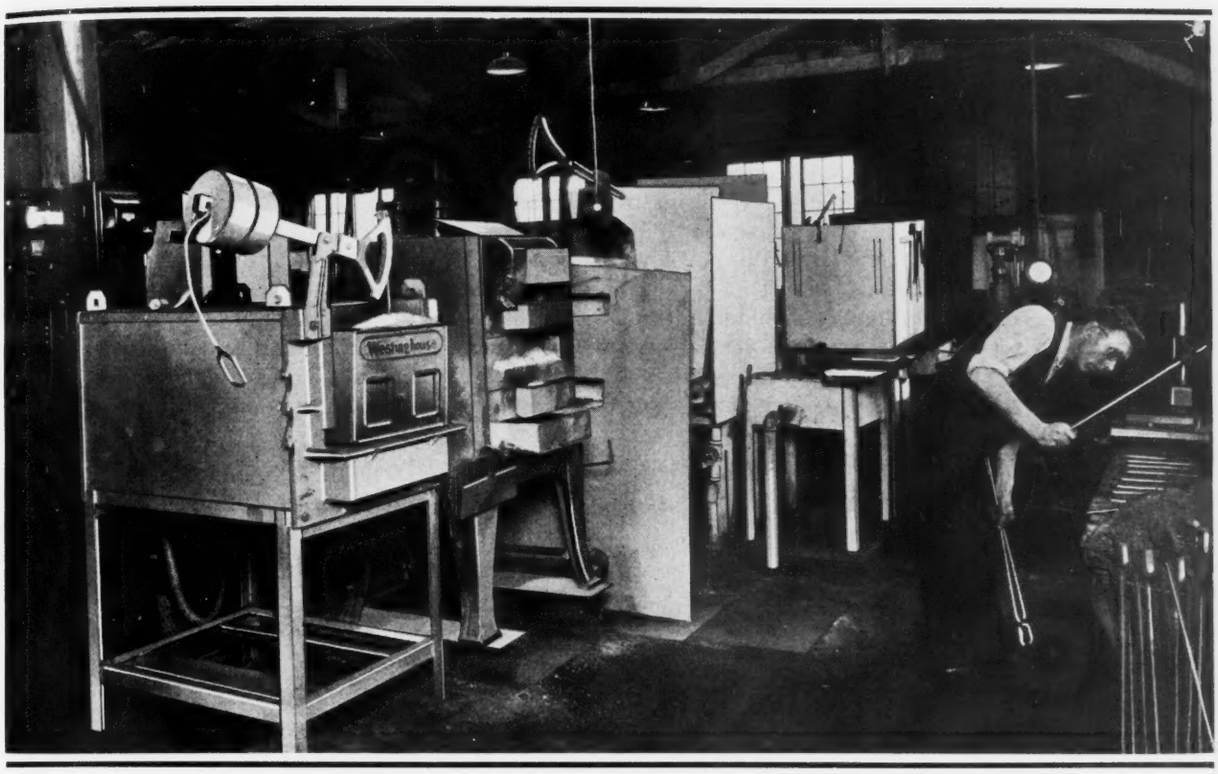
Why are these ardent advocates of hand labor in place of machinery so inconsistent? Why do they not advocate forbidding the farmers to use threshing machines and mowers? Why not return to the flail and the scythe? Surely this would increase employment in the agricultural regions and help to reduce unemployment in the cities by the call "back to the farm." Why not abandon machines in transportation and return to the ox team and the wheelbarrow? How this would increase employment!

Back to the Shovel; Why Not to the Flail and the Scythe?

But perhaps the ardent advocates of a reduction in the use of machinery in the industries dimly realize that, after all, the standard of living in the United States is in some way tied up with the generous use of machinery in this country. Perhaps they realize that a return to hand methods, could it be accomplished, would reduce us all to the living conditions of a century or two ago. Apparently, it is only the use of some types of machines that they would like to see curtailed; we have not yet heard them express preference for traveling across the country by stage-coach instead of in a Pullman.

Why should it be so difficult to understand that the greater the ease with which the products of industry and agriculture are produced, the more will there be to be shared by those who labor; and that the more efficiently public work is carried out, the less will be the burden of taxation? If we are unable to so arrange the affairs of our nation that we can live in comfort in the midst of abundance, let us at least not blame the machine.

"Many concerns waste a great deal of time and money in research by going over ground that has been thoroughly investigated by others," says a well-known metallurgist who directs the activities of a large organization devoted to scientific and industrial research. He says that if the searcher after facts would only consult the technical literature on the subject that is already in existence, his problems might be immediately solved and costly mistakes avoided. Start your research in the library rather than in the laboratory.



Welding Cutter Tips to Tool Shanks

Methods Used at the Westinghouse Plant for Welding High-Speed Steel and Stellite Tips to Low-Carbon Steel Shanks

By J. M. HIGHDUCHECK, Supervisor Cutting Tools and Applications
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

THE procedure followed at the East Pittsburgh plant of the Westinghouse Electric & Mfg. Co. in the selection and application of modern metal-cutting materials was described in September MACHINERY, page 12. The methods used at this plant in welding tips of the different cutting materials to low-carbon steel shanks are described in the present article. The material generally used for the shanks of tools tipped with the cutting materials regularly employed contains 0.50 to 0.63 per cent carbon; 0.60 to 0.90 per cent manganese; 0.04 per cent phosphorus; and 0.15 per cent silicon.

The cutting tip materials that are dealt with in this article, and pertaining to which instructions are given, include tungsten high-speed steel; low-cobalt high-speed steel; high-cobalt high-speed steel; Stellite No. 3; and Stellite J-Metal. The first step is to drop-forge a seat in the tool shank for the tip. After the forged seat has been cooled, the scale is removed by sand blasting. Tips are cut from bar stock according to dimensions on standard detail drawings.

A welding compound or flux known by the trade name of "Tip-it" is used in welding the tip to the shank. The flux is placed on the seat of the shank and the tip is then put on top of the flux in the desired position. The quantity of flux used depends upon the size of the tool being welded and must be estimated by the operator. The tool is placed in the preheating chamber of the furnace (see heading illustration) and heated to 1550 to 1600 degrees F., allowing sufficient time for complete penetration of the heat. The tool is then removed from the preheating chamber and the tip is pressed firmly to the seat of the shank to insure a close contact between the two pieces.

Next, the tool is placed in the main furnace chamber and heated rapidly to a temperature of approximately 2250 to 2400 degrees F., depending upon the kind of material used for the tip and its hardening requirements. Then it is removed from the furnace and sufficient pressure applied to the tip to force out the slag and insure perfect cohesion. The press used for this purpose should be equipped

with a pivoted pressure shoe to enable the operator to obtain varying pressures. The shoe must be preheated to prevent cracking of the tip.

It must be remembered that the hardening is accomplished at the same time as the tipping operation when tools are tipped with low-cobalt high-speed and high-cobalt high-speed steel. In order to obtain the greatest degree of "red hardness," the steel should be brought rapidly to the higher temperature, but in many cases, the shape of the cutting edges of certain form tools, such as milling cutters, threading tools, etc., makes it inadvisable to use the higher temperatures, which cause blistering or pitting of the delicate edges. It is, therefore, customary to use the higher temperatures for tools such as rough lathe tools, while the finer class of tools are hardened at the lower temperatures.

Another point to remember is to avoid holding any high-speed steel tools at the high heat any longer than necessary, since holding a tool at the high hardening temperatures causes excessive grain growth, with subsequent brittleness. Tools that cannot be ground after hardening are often heated in barium chloride or some similar salt bath. After the pressing and welding operation, the tool is cooled to room temperature under an air blast or quenched in oil.

It is advisable to maintain the oil quenching bath at a temperature of 150 to 200 degrees F. After the tipping operation, the tool should be reheated uniformly in an open furnace to a temperature of 1050 to 1150 degrees F. and allowed to cool in air. The hardened tools should have a minimum Rockwell C hardness of 63.

Unusually Long Employment Records

Many of the companies in the machinery and tool field are able to point with pride to the long service records of their employes; among these is the Cleveland Twist Drill Co. Over 90 per cent of the men and women employed in the factory have been in the company's employ 5 years or more; two-thirds of all the factory employes have been employed for more than 10 years; and considerably more than one-third over 15 years. Over 16 per cent of the employes have a service record of over 20 years, and 10 per cent have been in the company's service for 25 years or more.

When the record of the foremen is examined, this is even more startling. All foremen have been in the company's service over 10 years; nearly 75 per cent of them, over 20 years; and over one-half, more than 25 years. Fourteen men, each the head of an important department in the plant, have been with the company 28 years or more. Those having over 40 years in the company's service to their credit are Jacob Wentling, 48 years; Charles Kosier, 44 years; George Jones, 42 years; and C. W. Gieseler, 42 years.

The office staff presents an equally interesting record. Here we find that two-thirds of the men and women employed have been with the company for over 10 years, and about 20 per cent over 25 years. The same applies to the sales organization; one-third of the salesmen have been with the company for over 25 years, while about 85 per cent have been with the company over 10 years. In this connection it might be added that, unlike many concerns during the last four years of depression, the Cleveland Twist Drill Co. has not reduced its sales force, but, on the contrary, has increased it by adding three new men.

It is unnecessary to say that there must be unusually satisfactory relations between a company and its employes when such service records can be quoted. For example, since 1915, the company has had in effect a profit-sharing plan which is believed to be a model for other similar plans. In February, 1916, all employes who had been with the company two and one-half years or more received a dividend amounting to 10 1/2 per cent of the year's wages; those who had been with the company a shorter period received one-half or three-fourths of that amount.

This plan is still in force; and in December of each year that has shown a profit, a distribution is made to all employes who have been with the company six months or more. More than $1,000,000 have been paid out to the company's employes in this way from the company's profits. In many other ways are the friendly relations cemented, the above being only one example of the methods used to make the bond between men and management closer, and to create a truly cooperative spirit. It is by such cooperation that true industrial progress is insured.

* * *

New Metallic Lead Packing

A plastic metallic lead packing has been placed on the market by the Armite Laboratories, 1450 E. 61st St., Los Angeles, Calif. This packing is especially designed for severe operating conditions, such as found in the chemical industries. The packing is known by the trade name "Plastic Bestolife" and consists of a mixture of long-fiber asbestos, cotton, and a finely divided metallic lead with a lubricant in such proportions that under ordinary pressures a metallic lead seal is formed in pump and valve stem glands. The material is furnished in two grades: One for water, acids, alkalies, and salt solutions; and the other, for gas, oil, and petroleum products.

Using Dry Ice in Assembling Automobile Valve Seats

A Unique Shop Application of Solid Carbon Dioxide that Saves Time and Eliminates Rejections

THE engines of all Chrysler, Dodge, De Soto, and Plymouth automobiles, Dodge commercial trucks, and Amplex industrial and marine power plants are fitted with rings of a hard, tough cast alloy that serve as seats for the exhaust valves. The fact that the valves seat against a tough alloy instead of against the iron of the cylinder block, makes it possible to run the engine at least 30,000 miles more than formerly before the valve seats require regrinding. Another advantage of this construction is that the valves close tighter, thus improving compression and saving gasoline and oil. Two of the valve seat rings are shown in Fig. 2.

These valve seat rings are approximately 1 9/16 inches outside diameter, and are finish-ground all over. They are fitted into recessed holes that have been rough-, semi-finish-, and finish-reamed to size within plus or minus 0.0005 inch. Formerly each ring was chamfered slightly around the upper outside edge and the corner of the recess was rolled or peened over this edge to hold the ring in place. With this method of assembling, difficulties arose from cylinder block distortion, as it took four or five hard blows of the hammer to drive a ring into place.

Several months ago, it was decided to try shrinking the valve seat rings in dry ice refrigerators and assembling them while they were contracted. This method proved so successful that it has been adopted as standard practice in the various plants of the corporation. The rings are shrunk about 0.0025 inch and are then from 0.001 to 0.0015 inch larger in diameter than the recessed holes into which they are fitted. They are driven into the holes with two light hammer blows, as will be explained later. When the rings expand to their normal diameter at room temperature, they press so firmly against the recessed walls that peening or any other means of holding them in the recesses is unnecessary. This dry-ice method of seating the rings entirely eliminates distortion of the cylinder blocks.

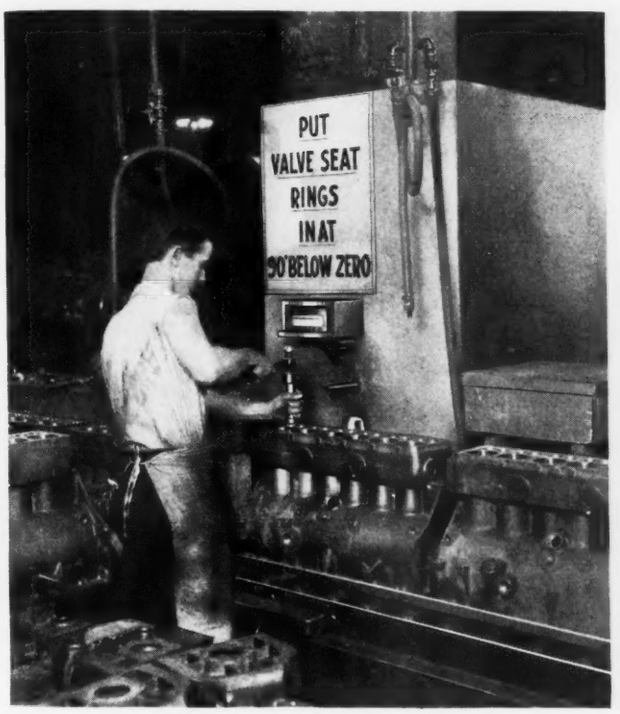


Fig. 1. Dry Ice Facilitates the Assembly of Tough Alloy Valve Seat Rings in Cylinder Blocks

The dry ice refrigerators used in the assembly of the valve seat rings measure approximately 45 inches high, 35 inches wide, and 40 inches deep, inside. There is an inner wall of pattern wood, 1-inch thick, and an outer wall of pattern wood, with a space between of 3 1/2 inches, filled with granulated cork. Aluminum paint applied to the outside deflects heat from the refrigerator. The inside of the refrigerator is large enough to receive twenty-four 10-inch dry ice cubes. This quantity of dry ice lasts for about five weeks.

A brass chute or track extends from the top of the refrigerator, winding back and forth through the cubes of dry ice, to a point just visible above the cylinder block in Fig. 1. The valve seat rings are placed in the chute through an opening in the top of the refrigerator, and roll down the chute through the refrigerating compartment to the unloading point. By the time they reach the unloading point, they have attained a temperature of at least 90 degrees F. below zero. Usually their temperature is considerably lower. The rings are ejected one at a time as the operator pulls a plunger on the front of the refrigerator. They generally remain in the refrigerator for about twelve minutes, but six minutes is long enough.

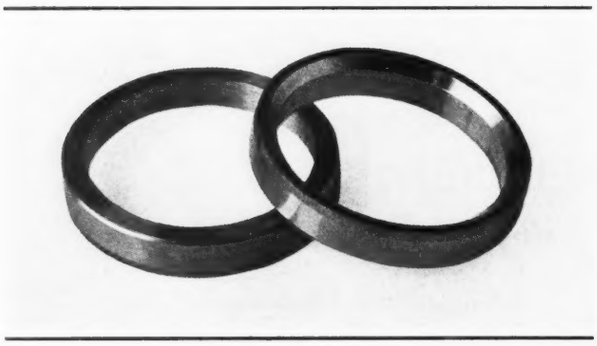


Fig. 2. Cast Alloy Rings Used as Seats for the Exhaust Valves for Automobiles Manufactured by the Chrysler Corporation

A thermo-couple is connected to the chute at the middle point and the temperature at that point is recorded on a Hoskins thermo-electric pyrometer located on the front of the refrigerator for convenient reference. At the rear door where the dry ice is placed in the refrigerator, rubber gaskets seal the opening against the entrance of air. Similar means are taken to exclude air at the points where the rings are loaded and ejected. Gas from the evaporating dry ice cubes escapes at these points and thus relieves the interior of the refrigerator from high pressure.

When the first refrigerator was constructed, this gas was allowed to circulate between the inner and outer walls, but it was found to raise the temperature of the refrigerator due to insufficient insulation. The result was that the refrigerator did not become colder than —78 degrees F. The use of granulated cork between the walls has solved this problem.

Fifty Blocks are Fitted with the Valve Seat Rings per Hour

In assembling the valve seat rings in the six-cylinder engine block seen in Figs. 1 and 3, a production of 50 blocks, or 300 rings per hour, is averaged by one man. The rings are taken from the refrigerator by hand and slipped, one at a time, on the mandrel *A*, Fig. 3. This mandrel has a long pilot at the lower end which is entered into the valve stem guides in the cylinder blocks to position the rings squarely with the recessed holes.

Two hammer blows are struck lightly on the upper end of the mandrel to force the rings into place. When the photograph reproduced in Fig. 3 was taken, the three right-hand valve seat rings only had been assembled. No trouble has been experienced by the assemblers in handling cold valve seat rings with the bare hand, because each ring is held for a very short time.

The expansion of metal parts by heating them has long been practiced in assembly operations when parts must be tightly mounted on other members. A case in point is the expansion of locomotive tires in furnaces for conveniently mounting on the wheel centers. When the tires contract to normal temperature, they become solidly fastened to the wheels.

Dry ice enables a reverse method—that of shrinking parts to facilitate assembly. It is a method that is likely to find wide application in the future. In addition to the assembly operation described in this article, dry ice is being used by a prominent manufacturer of fire-fighting apparatus for assembling cylinder liners into engine blocks. The liners are shrunk several thousandths of an inch in a dry ice refrigerator and then easily slipped into bores in the engine blocks. As the liners expand with their return to normal temperature, they exert such a heavy pressure against the bore walls that a force of from 3000 to 5000 pounds is required for disassembly.

* * *

A new line of centrifugal pumps has been developed by the Worthington Pump & Machinery Corporation, Harrison, N. J., specifically for the refining and natural gasoline manufacturing industries. There are many new features in the design, adopted with a view to promoting safety, reliability, and low maintenance cost in refinery pump equipment, features that may be of value in other fields of the manufacturing industries.

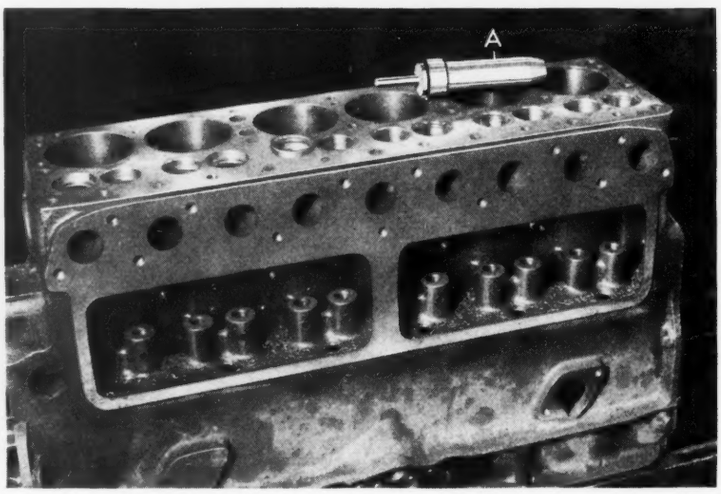


Fig. 3. Dodge Cylinder Block in the Midst of the Valve Seat Assembling Operation. Three of the Rings Have Been Driven into Place

Handling Small Lots on a Centerless Grinding Machine

One Plant Has Found it Profitable to Grind Small Lots of from Twelve to Six Hundred Pieces by the Centerless Method

THE centerless method of grinding has generally been looked upon as best adapted for high production. Recently, however, some manufacturers have found this method useful for grinding small lots, since the centerless grinding machine can be easily set up and quickly changed for different jobs. An example of this new adaptation of the centerless grinding machine to small lots is found in the plant of the Monarch Machine Tool Co., Sidney, Ohio. Here, over two hundred different parts are being successfully ground on a Cincinnati centerless grinding machine. Fifty-seven of these parts, consisting of shafts, pinions, studs, and other machine details, are shown in Fig. 3.

Fig. 1. Grinding the Taper on Lathe Centers in Small Lots on a Centerless Grinding Machine

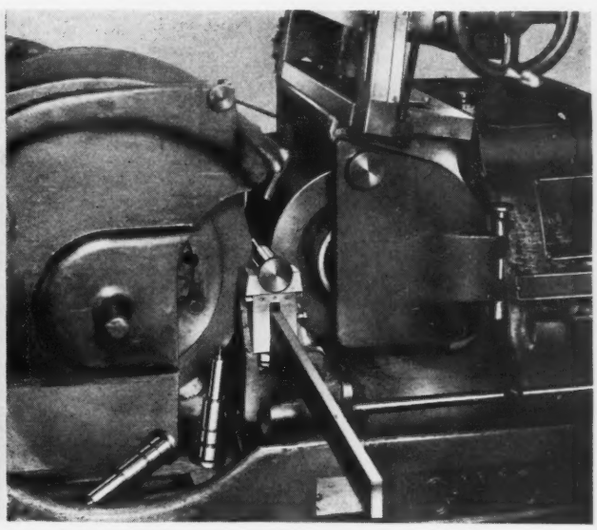


Fig. 2. Grinding Three Cylindrical Surfaces of a Cross-feed Screw Sleeve at 1.7 Minutes per Piece

At this plant, a comparative time-study analysis has been made, showing the total savings for each lot of parts, as compared with methods previously used. The average lot quantity was found to be 86 pieces, the minimum 12 pieces, and the maximum 600 pieces. The total saving in machining time over former methods, was 228 hours on the fifty-seven parts shown in Fig. 3 alone.

For example, bushing No. 3 is ground on two "diameters." This piece is made in lots of 18. The setting-up time for grinding by the former method was 14 minutes and the grinding time 7.12 minutes, as compared with 60 minutes setting-up time, 1.88 minutes grinding time by the centerless grinding method. Although centerless grinding requires 46 minutes longer set-up time, there is an actual saving in time on a lot of 18 pieces of about 48 minutes.

The cast-iron cross-feed screw bushing No. 24 is made in lots of 12 pieces. Here the time was reduced from 3.61 minutes per piece to 1.1 minutes by centerless grinding. The steadyrest jaw No. 27 was put through in lots of 600. On this part, the time required for grinding was reduced from 5.26 minutes to 0.7 minute per piece. The net saving in time per lot was 45 hours 22 minutes.

A formula may be devised for determining whether or not a lot of parts should be finished on the centerless grinder. In the following formula, let

A = set-up time for centerless grinder;
B = set-up time for present method;
C = grinding time for present method;
D = grinding time for centerless grinder; and

E = value determining whether or not the work should be performed on the centerless grinder.

Then,

$$\frac{A - B}{C - D} = E$$

If the value E obtained from this formula is less than the lot quantity, the job is suitable for centerless grinding. If the value E is greater than the lot quantity, the centerless method is not suitable.

As an example of the application of the formula, assume that a lot of fifty bushings is to be ground and that the following data have been obtained by the time-study department:

Set-up time for present method, 13 minutes;

Set-up time for centerless grinding, 30 minutes;

Grinding time per piece by present method, 4.44 minutes;

Grinding time by centerless grinding, 0.7 minute.

Substituting these values in the formula, we have:

$$\frac{30 - 13}{4.44 - 0.7} = 5 \text{ (approx.)}$$

The value 5 is less than the lot quantity 50; hence, this particular lot can be finished advantageously by the centerless grinding method.

In the Monarch plant, the operator is in complete charge of the centerless grinding machine and is responsible for the grinding of every part that can be profitably finished on the machine. Simple workrests, blades, and other equipment have been developed at low cost by the operator to enable a wide variety of pieces and many sizes of work to be handled. All work similar in shape and of nearly the same diameter is routed to the machine at the same time. This materially reduces the set-up time.

The figures quoted present another interesting demonstration of the fact that machines that are generally thought of as suitable for large production, may often be profitably used for small lots.

Samples of Finished Surfaces Wanted

A sub-committee of the committee of the American Society of Mechanical Engineers on standardization of classification and designation of surface qualities, is endeavoring to obtain from machine tool builders, as well as users, samples of what each manufacturer considers the minimum number of standard classifications for the surfaces produced by various machines, and recommendations as to the use of each classification.

Accordingly, interested manufacturers are requested to communicate immediately with John S. Chafee, Brown & Sharpe Mfg. Co., Providence, R. I., who is chairman of the sub-committee referred to, advising him if they are willing to submit samples as outlined in the following: The samples should be made from SAE 1020 steel and be approximately 4 inches long by 1 inch in diameter for turned samples; and 2 1/2 inches long by 2 1/2 inches wide by 3/8 inch thick for milled or planed surfaces, except in special cases where a larger sample is required, as, for example, where very coarse feeds are used.

It is requested that all samples submitted should be stamped with the name of the company submitting them, and that each piece should be stamped with a different designating number, the series to begin with "1" for the highest grade finish recommended as a standard classification. Only one finish should be shown on each piece.

It is requested that the samples be submitted not later than February 20, but those who plan to submit samples are asked to advise Mr. Chafee at once, informing him of their plans.

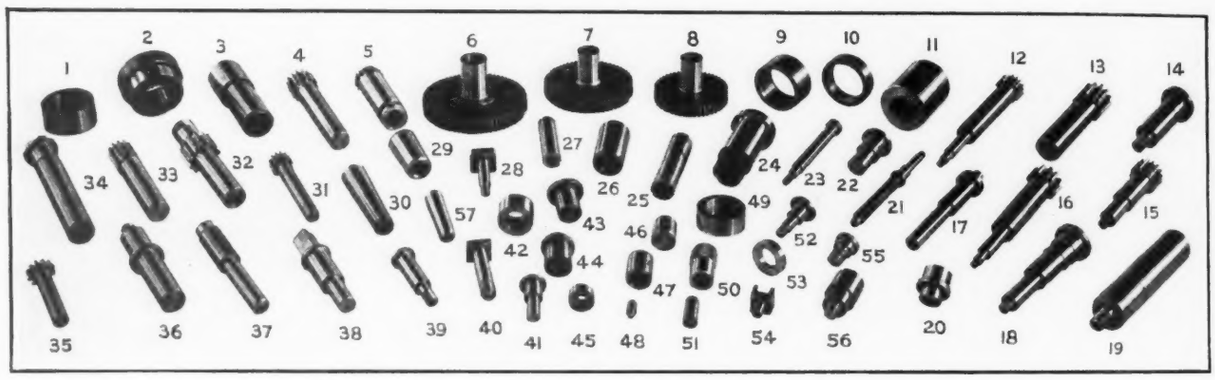


Fig. 3. Fifty-seven Varieties of the More than Two Hundred Parts Finished by the Centerless Grinding Machine Shown in Figs. 1 and 2

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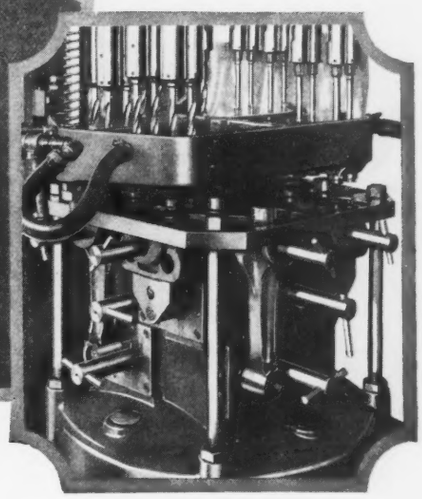
Motor and truck users pay 11 per cent of all taxes in the United States—federal, state, and local.

Design of Tools and Fixtures



Fixture for Grinding Elongated Punches

By P. F. ROSSMANN, Detroit, Mich.

A grinding fixture designed to make possible greater uniformity and accuracy in the manufacture of elongated punches and dies is shown in Fig. 1. The principle on which this fixture operates is illustrated diagrammatically in Fig. 2. Driving gear *A*, Fig. 1, rotates about a fixed center, located on the horizontal center line *Y–Y*, on the turret which consists of the cylindrical body *R* and disks *C*. The oval-shaped gear *B* has rack teeth at each side between points *S* and *Z*, which join the spur gear segments at each end. This oval gear is mounted on slide *D*, the travel of which is limited by the length of the slide space or slot. The length of this slot is such that when slide *D* is stopped at the opposite end *E* of the slot, the point *Z* will coincide with point *S* at the intersection of lines *X–X* and *Y–Y*. The spring-actuated roller plunger *F* and the detent notches *N* in the turret body *R* are provided to prevent rotational movement of the turret while slide *D* is moving laterally in the slot.

In operation, the rotation of gear *A* (see view to left, Fig. 2) causes gear *B* on the slide to move vertically upward to the second position where point *Z* stops at the intersection *S* of center lines *X–X* and *Y–Y*, which is the center of the turret. This is the position in which gear *B* is shown in Fig. 1. At this point, a rotational movement of 180 degrees is imparted to gear *B* and the turret, which carries gear *B* through the third to the fourth position. This results in the point *S* shown in the first position changing places with point *Z*. The cycle just described is then repeated.

The punch to be ground is mounted on the slide *G*, Fig. 1. The position of the grinding wheel relative to center line *X–X* determines the punch radius. The length of the lateral movement imparted to slide *G* by slide *D* can be varied through the adjustment of the pivot point *H* on arm *K* and by placing the pivot fulcrum pin *J* in one of three different holes. This adjustment simply provides

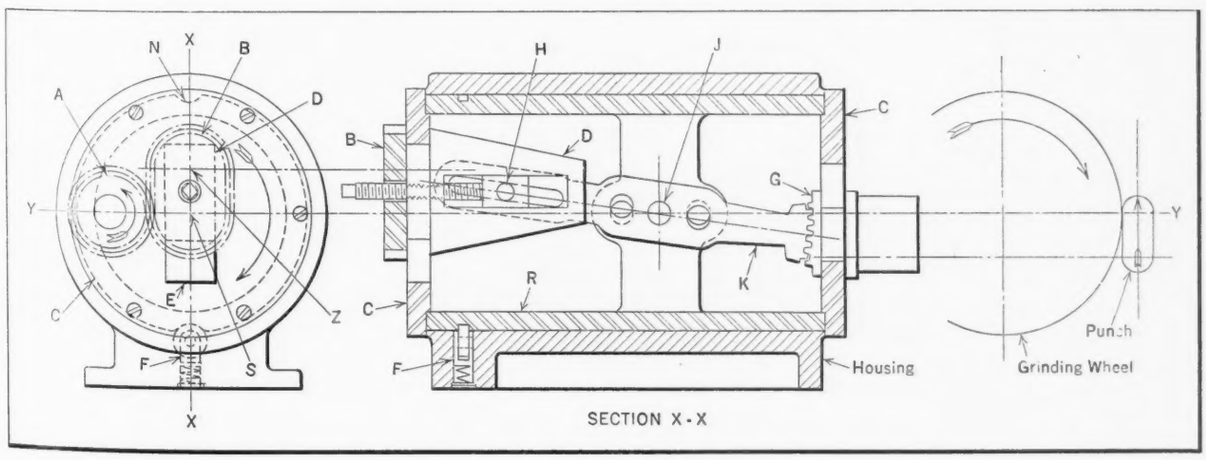


Fig. 1. Fixture for Grinding Punches and Dies Used for Blanking or Piercing Elongated Holes in Sheet Metal

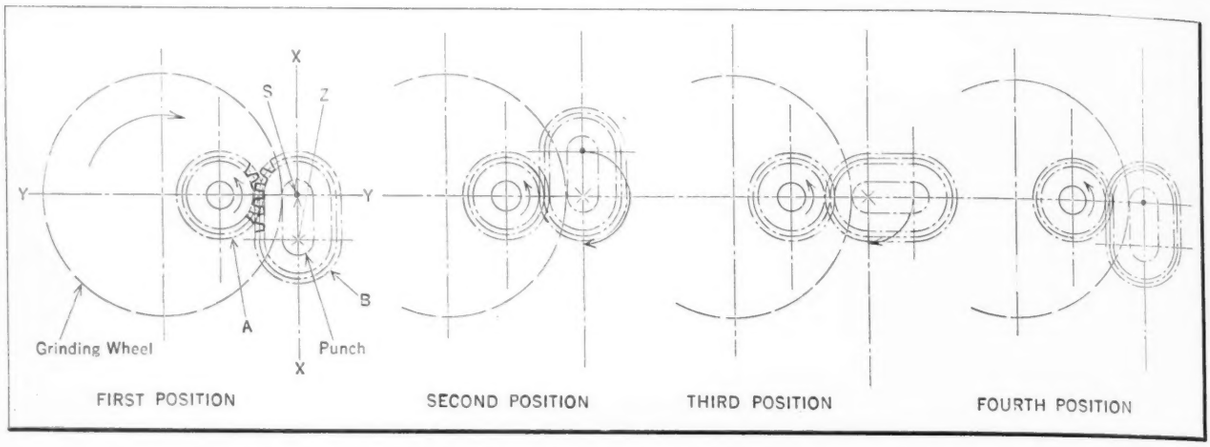


Fig. 2. Diagrams Showing How Fixed Pinion A and Elongated Gear B Function in Grinding Elongated Shapes with the Fixture Shown in Fig. 1

means for changing the ratio of the length of the arm from *J* to *H* and the length from *J* to the pitch line of the segment gear that transmits the lateral movement to slide *G* on which the work is mounted. For grinding elongated dies, the grinding spindle is mounted on slide *G* and the dies are held stationary. An interesting feature of this grinding fixture is that the surface being ground moves at a constant velocity.

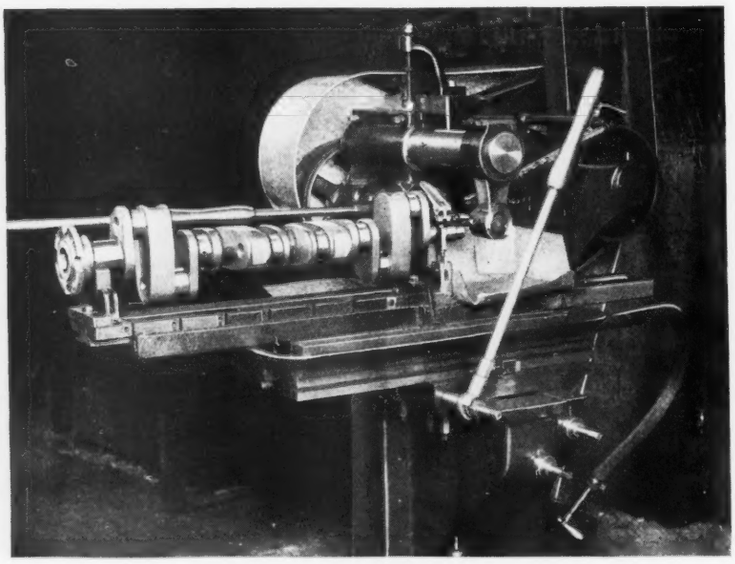
Milling Woodruff Keyways in Crankshafts

By E. E. BURKE, Kent-Owens Machine Co., Toledo, Ohio

Woodruff keyways, 1/4 inch wide, are milled by a cutter 7/8 inch in diameter, in 120-pound crankshafts like the one shown in the accompanying illustration. The large size of the crankshaft suggests the need of a much larger milling machine than the one shown. However, this heavy-duty, hand-operated miller equipped with the special fixture shown has proved amply rigid and capable of giving the very satisfactory production rate of sixty shafts per hour.

The plant in which this equipment is used produces a large variety of crankshafts, all of which must be accommodated by the work-holding arrangement. This is accomplished by using a long subplate having a dovetail cut its full length. The simple holding fixtures for the various shafts are correctly located and clamped in this dovetail slot.

The crankshaft shown rests in a vee at the rear and forward ends, the latter end being provided with a clamp. When released, this clamp is lifted from the shaft by a spring. This facilitates loading and unloading. An air hoist is used for placing and removing the work. The machine head has an extra long feed-lever which projects beyond the rear end of the crankshaft. This lever provides a convenient means for feeding the cutter quickly to depth. The table feed-lever is sometimes used for locating shafts having two or more keyways.



Cutting Woodruff Keyways in 120-pound Crankshafts at the Rate of Sixty an Hour, on a Hand-operated Miller

Die for Rolling Inscriptions on Cylindrical Shells

By EUGENE L. SOLTNER, Philadelphia, Pa.

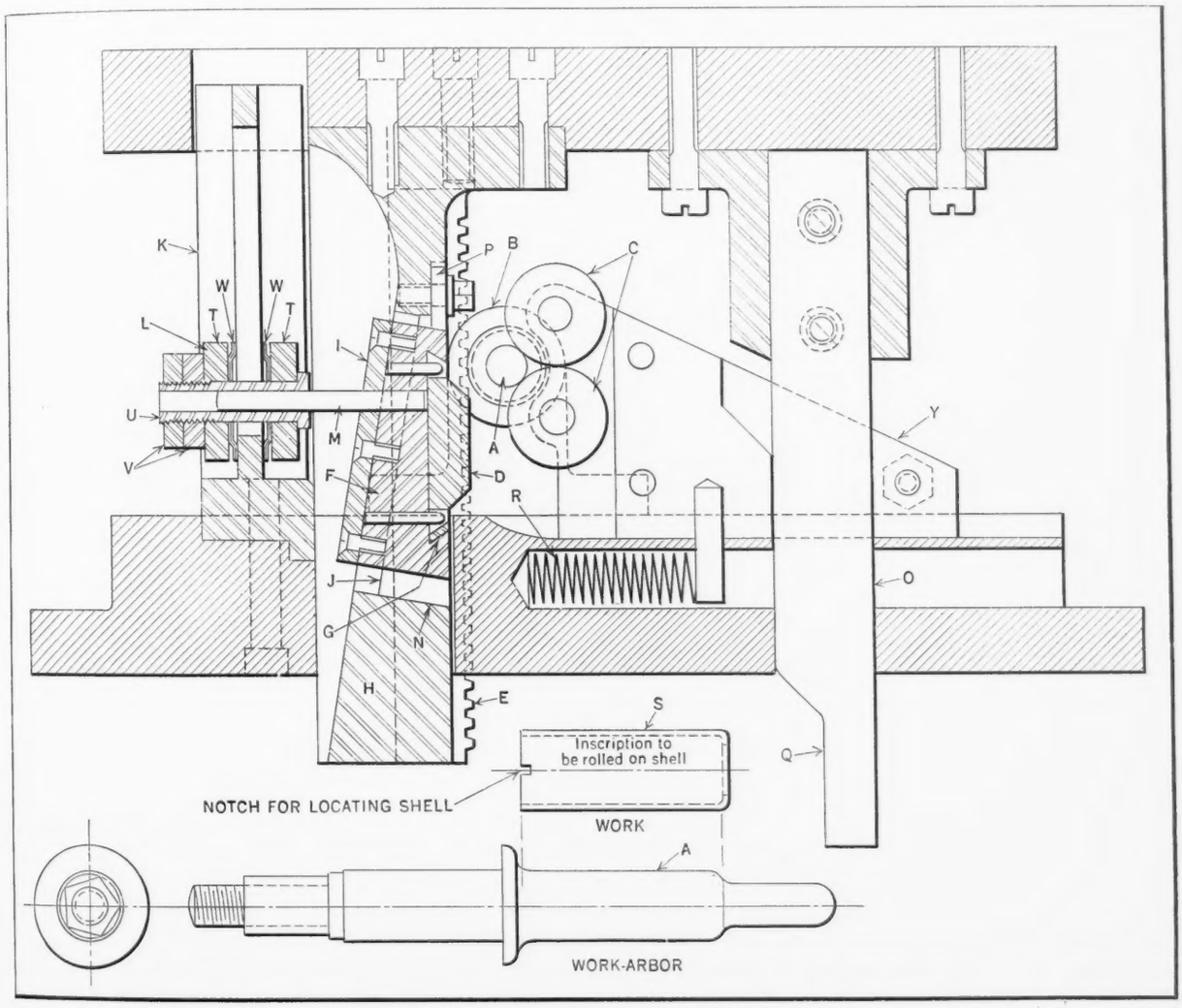
The rolling or marking of inscriptions on cylindrical shells is done ordinarily on special marking machines. The accompanying illustration, however, shows a die that was designed to do this kind of work. Briefly, the tool consists of the conventional die-bolster; punch-holder; means for mounting, supporting, and rotating the work; and the stamp for marking the inscription, together with convenient means for adjusting and moving it into and out of contact with the work.

The shells *S* to be marked are placed on the arbor *A*. The arbor has a bearing in the block *B* which is secured to the rear of the die-bolster. It also has a small-diameter extension on the front end by which it is supported against the thrust of the rolling operation by the rolls *C*.

Fitted to the other end of the arbor is a gear. This gear meshes with rack *E*, which is secured to the punch-holder. As the punch-holder and rack move up and down, the gear and arbor are rotated, turning the work at the same surface speed at which the stamp is moving.

When this die was designed, provision was made for marking five different inscriptions in as many different positions on the peripheries of the shells by having the arbor formed to a pentagon shape at the point where the pinion is secured. The pitch diameter of the pinion is 1 inch and the diameter of the work is also 1 inch. The pinion, having a similar shaped hole, permits the arbor to be advanced or retarded relative to the stamp an amount equal to 1/5 revolution of the work, or 72 degrees.

The rack and pinion being 24 pitch, will allow the rack to be moved up or down with relation to the pinion an amount equal to 1/24 of a revolution, or 15 degrees for each tooth movement, a five-tooth movement, for example, equalling an angular movement of the work of 75 degrees. From the foregoing, it will be evident that a differential movement is obtained between a five-tooth movement on the rack and one-fifth of a revolution of the arbor, which results in a net movement or adjustment of 3 degrees between the work and the stamp. This is equivalent to 0.026 inch on the surface of the work, which is close enough for ordinary marking operations.



Die Designed for Rolling Inscriptions on Cylindrical Shells

The stamp *D* for marking the shells is secured in a dovetail slot in the adapter *F*. Two pins fit into slots milled in the ends of the stamp and prevent side movement, while the tapered gib *G* locks it firmly in place. The adapter *F* is a T-section having a tongue which is fitted to a slot in holder *H* and secured to it by the shear plate *I*. The adapter, therefore, while being secured to holder *H*, is free

to move up and down the inclined surface *J*, the amount of movement being governed by the surface *N* at the bottom and the tapered wedge *P* at the top. By moving the tapered wedge *P* toward the front or rear of the die, a light or a heavy inscription can be rolled as desired.

In a tool of this kind, some means must be employed to move the stamp into and out of contact with the work. This is accomplished in the following manner: Secured to the die-bolster directly behind the stamp is the standard *K*. Straddling the center web of the standard is the friction clamp *L*. The friction clamp consists of two rectangular bronze metal shoes *W*, two heavy rectangular washers *T*, a threaded sleeve *U*, and two check-nuts *V*. By adjusting the check-nuts, the clamp is made to grip the standard with any desired pressure.

Secured to adapter *F* is the pin *M*. This pin is a sliding fit in sleeve *U* of the friction clamp. When the punch-holder and the projecting member *H* move up or down, the friction clamp, through the medium of pin *M*, holds the adapter from moving, causing it to slide along the inclined surface *J* until it is struck by the surface *N* or the wedge *P*. This moves the stamp into or out of contact with the work.

The die as shown is in the closed position. When open, with the ram in its topmost position, the adapter *F* rests against surface *N* and the friction clamp *L* is near the top of standard *K*. The operation then is as follows: A shell is placed on arbor *A*, the press is tripped, and the cam *O* moves the slide *Y*, with its supporting rolls *C*, into contact with the small end of arbor *A*. Holder *H* has also started to descend, but the friction clamp *L* has held the adapter *F* with its stamp *D* against any downward movement.

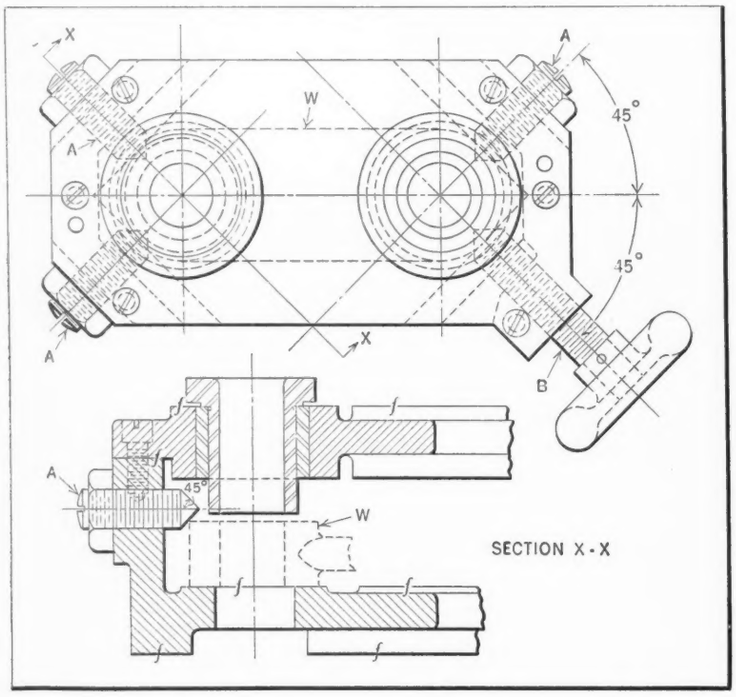
As member *H* continues to descend, the inclined surface *J* moves the adapter to the right until wedge *P* strikes it. The stamp is then in a position to mark the work, and the entire assembly, including the stamp, adapter, and friction clamp, is carried downward as a unit, rolling the inscription on the shell.

On the return stroke, friction clamp *L* again holds the adapter and stamp. Member *H* moves up and adapter *F* is forced to slide back along surface *J* until surface *N* comes into contact with adapter *F*. The stamp is then moved to the left far enough to clear the work, and the entire assembly ascends as a unit. At the same time, the surface *Q* on cam *O* has ascended to a position where slide *Y* is free to move to the right under the action of spring *R*. The work can then be removed.

Jig for Drilling and Reaming Link

By C. W. PUTNAM, Athol, Mass.

The jig shown in the accompanying illustration was made recently for use in drilling and reaming valve rod links of the type indicated by the dotted lines at *W*. The interesting feature of this jig is the method of using the conical-end screws *A* for adjustable work-locating points and the screw *B* for clamping. This design proved inexpensive to construct and rapid in operation, and the general idea may be found applicable in many instances.



Jig Using Screws with Conical Ends for Locating and Clamping the Work

* * *

Automotive Engineers Meet

The annual meeting of the Society of Automotive Engineers was held at the Book-Cadillac Hotel, Detroit, Mich., January 22 to 25. There were sessions devoted to almost every phase of automotive design and two important papers were read at the production session. Automotive transportation, maintenance, motor coaches and motor trucks, Diesel engines, aircraft engines and the regular type of automotive engines, body design, electrical equipment, fuels and lubricants, were all dealt with.

At the production session, Joseph Geschelin, engineering editor of *Automotive Industries*, read a paper on "External Broaching Applications in Current Production," while G. D. Bailey of the Detroit branch of the firm Ernst & Ernst discussed "Cost Accounting in Automotive Production." David Beecroft of the Bendix Aviation Corporation spoke on "What the NRA Means to the Automotive Field."

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

O. E.—What material would be suitable for a casting for a combustion chamber where the temperature rises to 2000 degrees F. and where both corrosion- and heat-resisting qualities are required? The tensile strength of the metal is not of as great importance as its resistance to corrosion and heat, since the inside pressure is only from 300 to 400 pounds per square inch.

Answered by "Nickel Steel Topics," International Nickel Co., Inc., New York City

A nickel-chromium, heat-resisting alloy containing 35 per cent nickel and 15 per cent chromium, with the remainder iron, is recommended. This material has very good resistance to oxidation at temperatures up to 2000 degrees F. and still retains an appreciable amount of strength.

Cyanide Hardening

E. G. B.—The following questions pertaining to cyanide hardening are submitted to MACHINERY'S readers: (1) In hardening by the cyanide process, is it preferable to use straight cyanide of potassium or are there other materials which, when added, would improve the depth of penetration and the degree of hardness? If so, in what proportions should these materials be used? (2) What is the best method of handling small articles—say, 1/4-inch set-screws—so that when they are withdrawn from the heating liquid and thrown in the water there will be no "explosion?" (3) What is the best material for the cyanide pots? Is heat-resisting steel recommended?

A.—The cyanides used for heat-treating are in two forms—sodium cyanide (which is most commonly used) and aerocase. [The latter chemical can be obtained from the American Cyanamid Co., 535 Fifth Ave., New York City.] Sodium cyanide is used mostly for obtaining a light case, 0.010 inch being the maximum depth that can be obtained. When a case over 0.010 inch and up to about 0.030 inch is required, aerocase has been used with satisfactory results, but sodium cyanide is always used when only a light case is required. The time required for the metal to remain in the solution usually varies from ten to thirty minutes. The rate of penetration is very slow after thirty minutes has elapsed; it takes about one hour to obtain a case 0.010 inch thick, and for a case 0.030 inch thick, obtained with aerocase, three hours is required. The time required for different depths of penetration varies with the steel and the temperature.

Sodium cyanide comes in different grades containing from 96 to 98, 75, 45, and 25 per cent pure cyanide. The grade most commonly used is the 45 per cent type, but the grade used depends to a great extent on the steel. Cyanide-chloride mixtures of 75 and 45 per cent grades are also used for hardening low-carbon steels and can be used to advantage for replenishing the cyanide content of depleted baths and for retarding decomposition of the sodium-cyanide bath.

The best method of handling small articles, like 1/4-inch set-screws, is to use perforated baskets. The best material for cyanide pots, according to experienced users, is Nichrome. Nichrome pots are guaranteed by the manufacturer for 2000 hours, but usually last from 4000 to 6000 hours. In any event, a nickel-chrome alloy is to be preferred to plain drawn-steel pots, the life of which is seldom more than from 100 to 400 hours. Steel pots also frequently leak; thus there is the danger of molten cyanide running into the furnace and damaging the brick lining, causing expensive repairs.

Effect of Verbal Statements on Sales Contracts

M. M. L.—I have been informed that a written sales contract can be affected by verbal agreements, if the complaining party proves that the verbal agreement was fraudulent. Is this true? If so, please cite an example.

Answered by Leo T. Parker, Attorney at Law Cincinnati, Ohio

An important and well established rule of the law is that irrespective of whether a contract is written, or partly written and partly verbal, proof of fraud entitles the complaining party to a favorable verdict.

Suppose a buyer and a seller enter into a written sales agreement and before the contract is signed, the seller makes certain fraudulent statements or promises by which the purchaser is induced to enter into the contract. The purchaser is entitled to sue and recover damages from the seller, or cancel the contract, solely on testimony showing that the seller used fraudulent means to induce the purchaser to make the contract. However, it must be remembered that if the alleged fraudulent statements contradict the written terms of the contract,

the Court will not consider testimony that is intended by the complaining party to prove the other party's verbal fraudulent promises or statements.

For example, a written contract specifies that the gears of a machine shall be made from cast iron, but the seller verbally states that actually they will be made from steel. Later, when the machine is delivered, the buyer cannot complain because the gears are made from cast iron.

On the other hand, suppose that a written contract does not specify the material from which the gears are to be made, and the seller promises that it will be steel. Under these circumstances, the purchaser would be entitled to relief and the Court would receive testimony proving the verbal promise, because such testimony would not vary the terms of the written contract.

Another exception to the general rule which will not permit the introduction of evidence of verbal promises to vary the provisions in the written agreement is where the seller has performed some act by which the Court may determine that the written contract was not intended to express the obligations of the contracting parties. For example, in a late case (277 Pac. 821) it was disclosed that an order form contained the following printed notation: "It is agreed there are no promises, agreements, or understandings not expressed on this form."

The salesman verbally promised that the material would be of a certain quality. When it arrived, the purchaser found that the quality was not as represented by the salesman. The purchaser refused to accept delivery and the seller filed suit. During the trial, the seller attempted to prevent the purchaser from testifying regarding the salesman's guarantee, because the guarantee conflicted with and contradicted the written terms of the contract which provided that "it is agreed there are no promises, agreements, or understandings not expressed on this form." However, since the purchaser proved that the seller had disregarded other written parts of the contract, relating to the method of shipment, the higher Court held the salesman's verbal guarantee to be a part of the contract, thus holding the seller liable.

How We Maintain Friendly Relations With Our Employes

By H. GOLDBERG, Vice-President, R. G. Haskins Co., Chicago, Ill.

EMPLOYES, like employers, are ordinary human beings. They have the same reactions and emotions and the same appreciation of a square deal.

Our factory is not a very large one, and I presume that our problems are not quite as involved as those in a larger plant. Nevertheless, regardless of the size of the plant, I have always maintained that an attitude of fairness toward every employe will reflect itself in the employe's attitude toward the firm.

In the last ten years, not one of our employes has left our employ to work for someone else, nor have we ever had any "troublemaking" of any kind. Our men have little or no supervision. They work on the "honor system" and take great pride in fine workmanship. The best reward we know of is placed in their pay envelope. We pay much more to our men for the same class of work than the average company, and have always done this. Yet we feel that we are well repaid for this extra compensation, and know of no better method of maintaining a good relationship between our employes and ourselves.

While it is true that our payroll for the number of men we employ is much higher than that of competing companies, we are quite positive that our manufacturing costs are lower. This is partially due to the fact that it has also been our policy to give our men the best equipment and tools, so that the full benefit of their skill and workmanship may be reflected in our product. This, together with the fact that we enjoy a feeling of security and freedom from "labor troubles," makes our policy appear to be worth while.

We have done a great deal to make the work in our shop pleasant and have reduced to a minimum the need for physical effort on the part of our men. In visiting some factories, one wonders why the management permits such an unnecessary burden of physical hardships to be placed on factory workers. We have aimed at making such improvements as will lessen the labor of our men. It pays to make work physically easy in the shop. When there is a minimum of physical effort and fatigue, a man has more opportunity to do constructive thinking about his work.

I feel safe in saying that most of the success that I have had in factory management is primarily due to the cooperation of the employes, and it has always seemed to me a very simple problem to obtain this cooperation and help; nor is it achieved by any trick system or magical formula—by any so-called "industrial relations plan" or "incentive system." It has all been accomplished by adopting a friendly attitude toward those working for the company and by trying to deal with them in the same manner as one would like to be dealt with.

Blast Cleaning in the Metal Industry

A Review of the Application of Blast Equipment for Cleaning and Finishing Metal Objects in all Branches of the Industry

By WILLIAM A. ROSENBERGER, Chief Engineer
Pangborn Corporation, Hagerstown, Md.

THERE is hardly an industry where blast cleaning, still widely known as "sand-blasting," does not constitute an important part of the daily routine, and its application is spreading to fields unthought of only a few years ago. A review of present trends in blast-cleaning applications is, therefore, most timely.

The term "blast cleaning" was proposed and quite readily accepted recently, because it became more and more apparent that sand, as an abrasive, had to step back, in view of the generally accepted superiority of steel abrasives. Not that sand is hopelessly doomed to oblivion—it still has its application and uses in industry—but steel abrasives have undeniably proved their superiority for most applications by their much greater durability, hard hitting qualities, freedom from dust, and economy.

Unfortunately, there is an odium about blast-cleaning equipment that is very difficult to live down. Memories from bygone days picture the blast-cleaning department as undeniably the dirtiest and most disagreeable place to work in and about. To what extent responsibility for this is to be placed at the door of the manufacturer of such equipment or at the door of the user, we shall not attempt to analyze. Part of it is inherent in the character of the blast-cleaning process, which, by its very nature and in order to be effective, must also be destructive. Small wonder, then, that users who have their first blast-cleaning equipment are often disappointed because of the tremendous wear and tear and the comparatively high upkeep cost.

Blast-cleaning equipment, however, cannot, and should not, be judged by maintenance cost, but rather by the over-all expense, incurred to obtain certain definite results, in comparison with the cost of any other method designed to accomplish the same results in the same time. If this is done, and assuming that blast cleaning is at all adapted to the work in question, it will be found that the cost per ton of work treated by this method is outstandingly lower than that incurred in using any competitive process; and, furthermore, it results in a surface finish that cannot be obtained by any other method, and which is essential for certain surface treatments unless the quality of the ultimate product is intentionally sacrificed.

In most cases, metal surfaces that are to be painted, lacquered, plated, galvanized, or metal-sprayed require a blast-cleaning treatment to obtain a really good bond between the metal surface and the "finish" to be applied.

The Blast-Cleaning Process Has Universal Application

No other method of cleaning iron, steel, and nonferrous castings is as thorough, quick, and economical as the use of a properly designed blast-cleaning equipment. There is no other equally efficient method for removing rust and scale from billets, steel shapes, plates, or for removing old paint, enamel, and plating. There is no work too delicate, no work too crude, for the proper applica-

William A. Rosenberger was born in Switzerland. After graduating from the Eidgenössische Technische Hochschule in Zürich, he came to the United States in 1909. In 1912, he entered the employ of the Thomas W. Pangborn Co., at that time located in New York and Jersey City. He is now chief engineer of the Pangborn Corporation. Mr. Rosenberger has made a thorough study of all the phases of sand blasting and dust collecting, and has developed a great many outstanding designs in these fields. His thorough engineering training and his mechanical ingenuity have created for him a prominent position in the mechanical field, and he is well qualified to write authoritatively on blast cleaning.

tion of blast cleaning. Anything from dentists' burrs (drills) to suspension bridges, from walnuts to railroad cars, has been and is being blast-cleaned.

There are very few objects around the average home that have not at one time or another been blast-cleaned. The hardware on doors, the switch panel of door-bells, kitchen sinks, pots and pans, bathtubs, faucets, razor blades, telephones, lighting fixtures, furnace castings—nine out of ten have been blast-cleaned for better appearance and finish. Most parts of automobiles, iron lamp-posts, gasoline pumps—even cups and saucers—have undergone this treatment.

These are just a few of the thousands of objects for which the blast-cleaning engineer must find a suitable method of handling and the proper way of cleaning. His recommendation, however, is further modified by innumerable different finishes which each particular industry requires for various products.

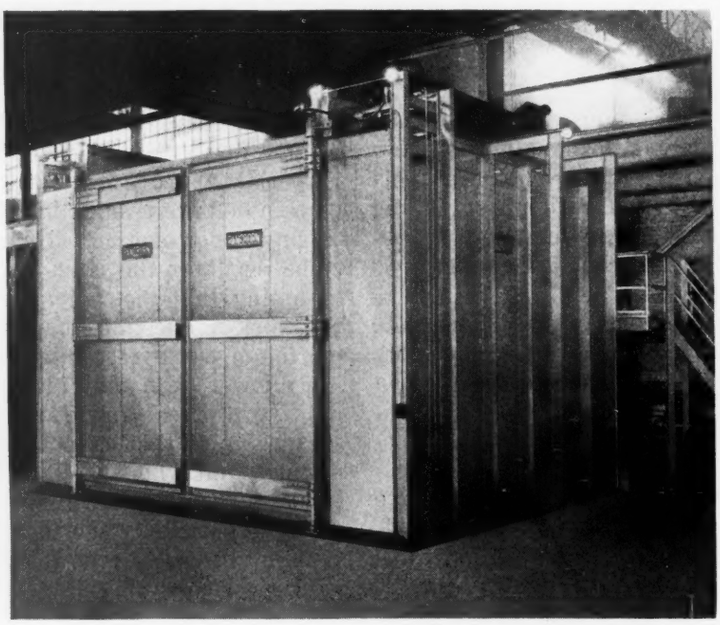
These finishes are obtained by the proper selection of any one of hundreds of available abrasives, by the use of the proper air pressure and the correct angle of impact, by the proper relative speed between the work and the blast stream, by the correct size (diameter), length, and shape of the nozzles, by the proper size of the abrasive hose and abrasive lines with respect to the area of the nozzle or nozzles used, and by the amount of abrasive propelled against the work in a given time.

All of the points enumerated must at one time or another be duly considered, particularly in the design of special blast-cleaning equipment. It is evident that a wide practical experience is essential for qualification as a blast-cleaning engineer. It will also be evident that users of such equipment, for their own good, should guard against recommendations made by anyone without a thorough understanding of all the facts.

This, quite naturally, leads up to the point of cooperating with the manufacturer of blast-cleaning equipment to the fullest possible extent. If the production is ten tons per day, the manufacturer should not be told fifteen or twenty, as this might easily result in a first cost far beyond what "the traffic will bear." If he asks for samples of work for experimental purposes, do not select the simplest nor the most difficult pieces, but rather some of each. Do not demand a finish beyond what is necessary to give the desired results. It is the extremes in surface treatments, as in any other field, that call for extra equipment expense, as well as operating and maintenance costs.

The Place for Automatic Blast-Cleaning Equipment

The tendency for some years has been toward automatic machines. This tendency is understandable and justifiable, but not always wise. There are many parts requiring blast-cleaning treatment that can be handled manually far more efficiently than is possible in a fully automatic machine. This is particularly true in the steel industry. Take, for instance, the problem of cleaning steel plates. Plates vary in hardness from the edges toward the center. Again, the scale frequently is entirely different on the two sides.



The Latest Type of "Hydro-Core-Knockout" Machine for Cleaning Large Castings by Water Blast

In an automatic machine, the plates are fed at a constant speed past a series of nozzles. The speed must be so selected that the parts most difficult to clean receive thorough treatment. This may require, by way of example, a speed of 20 lineal feet per minute. However—and I am speaking from actual experience—the same plate may have other areas that would clean up thoroughly at a speed of 60 feet per minute. The result, then, is that the portions easily cleaned are over-blasted; but, more serious than that, the production is greatly reduced, because the whole equipment must be slowed down for the proper cleaning of the hard spots.

In a semi-automatic equipment where one or more operators are employed to do the blasting, they see what they are doing. They will play the blast stream just sufficiently long over any given spot to

obtain the desired results, and then go on to another part which may clean up with a few swift strokes.

Of course, a careful analysis should be made in each case to determine whether it is more profitable to save labor at a reduced speed or to employ labor for maximum production. Humane considerations often decide in favor of automatic equipment, although it can be stated that modern protective devices, such as ample ventilation, and particularly properly designed and adequately ventilated helmets, make work inside a blast-cleaning room, if not altogether pleasant, certainly entirely free from any danger or health hazard to the operator.

The Hydro-Blast and the Work for which it is Used

Some reference to the hydro-blast may be of interest in this connection. This is not, strictly speaking, blast-cleaning equipment in the broad sense, but rather equipment designed for the special purpose of removing cores from medium and large size castings by a high-pressure stream of water. Water at from 300 to 500 pounds pressure is directed by means of a large nozzle, similar to those used for fire fighting, against the work, which generally is placed upon a heavy, motor-operated turntable inside a specially designed steel room. One or more positions are provided for the operators, who obviously are located outside the room.

The blowing out of cores has always constituted the worst job for a sand-blast operator, creating so much dust inside the ordinary blast-cleaning room that even the best practical ventilation could not satisfactorily cope with it. By doing this work with a stream of water, all the dust nuisance is eliminated, core-rods and wires drop out undistorted, and the job is done in a fraction of the time required by the old method. The accompanying illustration shows the most modern "hydro-core-knockout" room installed in this country.

The Centrifugal Blast Has Possibilities Not Yet Fully Developed

Another development recently revived is the centrifugal blast. In this equipment, dry abrasive is used; but, instead of compressed air, the propelling medium is a combination of "tangential velocity and centrifugal force." Contrary to general belief, the principle involved is very old, as evidenced by numerous long-expired patents. Extensive experiments were conducted in Germany and other European countries over twenty years ago; but mainly due to excessive wear of the rotor and other parts, and the difficulty of properly controlling the direction of the blast stream, the idea was given up.

Recently this matter has been revived; and it is not impossible that this method of blast cleaning may find some application—more, of course, as our knowledge of producing wear-resisting materials increases. At present, however, it is advisable to approach this development with considerable caution, as its cleaning efficiency is below that of a high-pressure air blast. On the other hand, for work easy to clean, it does not lack attractiveness, even at this early stage of its rebirth.

A Vital Feature is a Properly Designed Ventilating and Dust-Collecting System

In the early days, many "sand-blast" rooms were provided with two, three, or four air changes per minute. Often a simple disk fan was employed, blowing the dust outside of the building. In some cases, the dust-laden air was blown into a cyclone collector, the back pressure of which greatly reduced the amount of air actually handled. Naturally, conditions in a blast room with such inadequate ventilation were far from satisfactory, not only from a health standpoint, but also from a visibility standpoint.

The question, of course, comes immediately to mind: What constitutes adequate ventilation? The answer is not easy, because the human element enters prominently into the equation. What may seem good enough to me, may not satisfy you at all. Again, the reply to this question is only too frequently modified by pocketbook considerations, available space, and misjudgment of conditions.

It should be stated that the number of air changes in a blast-cleaning room is not necessarily a criterion of the quality of the ventilation, because the important thing is the velocity of the air passing the operator. To illustrate, let us assume a blast room 10 by 10 by 20 feet high, with down-draft ventilation. Five complete air changes per minute in this room would require handling 10 by 10 by 20 by 5 or 10,000 cubic feet of air per minute, which would result in an average down-draft velocity of 100 feet per minute.

The same amount of air similarly applied would produce 100 feet per minute down-draft in a room having only half the height of the one cited, or 10 feet. However, the number of air changes per minute would then be ten instead of five as in the higher room. Thus, it will be seen that no advantage would be gained by increasing the air changes in the higher room from five to ten; on the contrary, it would be a decided disadvantage from the buyer's viewpoint, because his ventilating and dust-collecting equipment would be twice as large as necessary, assuming, of course, that a 100-foot-per-minute down-draft would be adequate for his particular work.

It is, therefore, important in ventilating blast-cleaning equipment to decide upon a sufficient air velocity, and then arrange the ventilation, if at all possible, in such a manner that the air travels through the smallest cross-section of the equipment to be ventilated. By this means, worthwhile savings in ventilating and dust-collecting equipment can often be accomplished or higher air velocities

obtained without the extra cost required for larger equipment.

In recent years, an air velocity of about 75 feet per minute past the operator has been considered adequate for the average blast-cleaning room, particularly when steel abrasive is used and proper helmet protection is provided. When sand is used, a velocity of 100 feet per minute or over is advisable.

There Will be Continued Progress in the Application of Dust-Collecting Equipment

With sanitary requirements becoming stricter almost every day, it is no longer permissible in many states to return the air from the dust exhauster back into the factory, even when cloth-screen-type collectors are used. This, however, applies to jobs only where the dust created and collected contains silica, which is the case in all sand-blast operations, most grinding jobs, stone cutting, and other trades.

The use of cyclone collectors of present designs will undoubtedly be prohibited in every state for use with blast-cleaning and similar operations. While this may seem a hardship, particularly for the smaller shops who feel that they can ill afford the initial cost of a cloth-screen collector, we must not lose sight of the fact that the saving of human lives, or, at the very least, the prolongation of human life deserves almost any sacrifice on the part of those whose vocation does not expose them to the hazard of deadly industrial dusts.

Dust-collector manufacturers are bending every effort toward developing designs that are more efficient, more durable, and easier to maintain and repair. Research along these lines is going on continuously at the silent battle front of industry; but it requires the cooperation, the confidence and help of the user of both blast-cleaning and dust-collecting equipment to obtain quickly the results we are all striving for, namely, equipment that is both safe and efficient.

* * *

Safety Precautions in the Use of Chromium and its Compounds

The Industrial Health Section of the Metropolitan Life Insurance Co., 1 Madison Ave., New York City, has issued a booklet entitled "Protection of Workers Exposed to Chromium and Its Compounds." In industrial work, exposure to chromium and its compounds may cause troublesome, though not serious, effects on workers if no precautions are taken. This little book will be sent free of charge by the Metropolitan Life Insurance Co. to those who ask for it. It shows how the effects of chromium and its compounds can be wholly eliminated, or reduced to such a minimum as to become negligible, and should be of value to all those who are engaged in handling materials of this kind.

The Cheerful Side

The orders received by the General Electric Co. during 1933 amounted to $142,770,791, as compared with $121,725,772 for 1932, an increase of 17 per cent. Orders for the quarter ended December 31 were 39 per cent ahead of those for the last quarter of 1932.

Once again the automobile industry has demonstrated astounding virility. Beginning the year 1933 most inauspiciously, it revived as if by magic and ended the year with a production figure just over the two-million mark. If the industry could produce and sell 2,000,000 cars and trucks in 1933, a year of great uncertainty, there is every reason to believe that a better performance will be staged in the present year, and talk of a 2,500,000 or more output is not an idle boast.—*Commerce and Finance*

Approximately 363,000 motor trucks were built by American manufacturers last year as compared with 237,500 in 1932. This marks the first increase for any twelve-month period since 1929. This 48 per cent increase reflects not only improvement in general business conditions, but also the pressing need for new motor truck equipment to fill present requirements.

The Acheson Oildag Co., Port Huron, Mich., has announced that beginning January 1 a salary and wage increase to all employes of 5 per cent was put into effect.

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Dies Sent by Air from Chicago to Los Angeles in a Day

A die-stamping concern in Los Angeles, Calif., was called upon by the Navy Department to furnish medals for presentation to certain men in the naval forces "the day after tomorrow." The dies for these medals were in Chicago. In order to enable the medals to be stamped in time, they were shipped by railway express plane, taking off from Chicago at 7 A.M. and reaching Los Angeles at 11:15 P.M. The night shift in the die-stamping plant completed the medals in time for presentation the following day.

* * *

Speed Reducer with 27,000-to-1 Ratio

A controllable pitch propeller so designed that the pilot can change the propeller pitch while in the air has been developed by the Curtiss Aeroplane & Motor Co. of Buffalo, N. Y. This design is made practical by a very compact speed reducer which is part of the design. This device reduces the motion of the electric motor operating the controlling device in the ratio of 27,000 to 1. The speed reducer is built by the Universal Gear Corporation, Indianapolis, Ind., and is known as a heliocentric type reducer.

Using Sound as an Indicator in Industrial Operations

By P. H. BRYANT

A CONSTANTLY broadening field has been found for the light beam as applied to industrial work. Is it not possible to use sound in a similar way? We have an "electric eye." Could we not develop an "electric ear"?

A production manager recently made some experiments to determine the value of cultivating the sound sensibilities of his operatives. The story of these experiments is, briefly, as follows.

It is a well established fact that the life of a cutting tool can be increased from two to five times by taking it out and having it reconditioned while the cutting edges are merely dulled, before they become burned or scored to any considerable degree. In some departments, therefore, a uniform time or number-of-pieces factor was established for each tool grind. The dull tools were replaced by sharpened tools at the conclusion of each uniform period. This was done whether or not the performance of the tools indicated that such replacement was necessary.

In one department equipped with machines for threading the ends of large-diameter pipe, this practice resulted in little, if any, saving in tool cost. Though it could not be explained, it was, nevertheless, a fact that there was no relationship between the number of cuts that could be had from successive grinds of a set of threading tools. For example, a certain set might thread fifteen ends when new, eighty-five after the first grinding, and six after the second. Following that short run of six, which would seem to indicate a definite deterioration in composition or hardness, the next run was as likely to be fifty or sixty as a smaller number.

From records kept of the complete life of a large number of marked sets, it developed that the average was about thirty-five ends per grind. It was found, however, that no economy resulted from using that figure as a basis for standardizing the length of runs, as, by so doing, many sets would be ground away needlessly, while others were being damaged in attempts to stretch runs to the fixed limit when the operator's judgment would have cut the run short and prolonged the tool life.

Maximum production and maximum tool life could be obtained only by continuing each run to the point where the tools were on the verge of going bad, but stopping short of appreciable damage to either tool or work.

Another fact was established from this investigation, and here is where the experiment with sound began: One of the observers engaged in collecting data noted that there was a difference in pitch in the hum characteristic of all metal-cutting machines in operation, when the tools were sharp and when dulled. The pitch, if we may call it that, started at a uniform "high" when the tools were newly set and sharp, and gradually dropped like a modified blast from a slide trombone; then, just before the point of tool collapse was reached, it took on a new definite sound quality.

By concentrating attention on these sound characteristics, the observer discovered that he could school his ear to detect with certainty when the danger point was near. In that way, he could obtain a marked decrease in tool damage. Satisfied that he himself could pick the critical point in this way, he set out to coach an operator and found that he also could get the warning signal, *provided his attention was concentrated on the sound alone.*

The next step was to train the whole operating force to detect by ear when tools were near the breakdown point and needed replacements. This experiment failed, however. Nearly all of the operators were found to possess the faculty of sound selection to a degree that enabled them to detect the critical pitch; but not one of them could catch the sound while doing other work at the same time.

Now the question is: Would it not be possible to construct some device that would automatically record tone pitch, independent of a human agency, and relay this record in such a way that it would meet the requirements of shop practice? For example, if the humming of those threading machines could have been translated into readings on the face of a large dial having a range from sharp to dull, very dull, and danger, any operator could have kept tab on the condition of his cutting tools by an occasional glance at the dial. What men dream about today becomes the commonplace of tomorrow; and if some electrical engineer begins to dream of an "electric ear," we are likely to have it before long.

* * *

Since 1911 the number of locomotives in service on American railroads has decreased 8 per cent, but the average tractive power of the locomotives in service has increased 64 per cent per engine. In other words, the locomotives in use today, while fewer in number, are able to haul more than 50 per cent additional load.

How the Product Designer Helps to Increase Sales

Originality in Appearance and Artistic Design are Becoming More and More Recognized as Vital Factors in Sales Campaigns

By HERBERT CHASE, Consulting Engineer, New York City

WHEN sales increases as high as 400 per cent are obtained merely by simple and attractive changes in appearance, it is obvious that product designers and manufacturing executives must give this factor due consideration. A case in point is that of the heater now being produced by the American Gas Machine Co. Originally, this product, following tradition, was made to look much like the once popular phonograph cabinet. (See Fig. 1.) In that form, it gained a fair sale, largely because of certain mechanical features, but it looked much like competing products. It was finished to simulate wood, and so seemed an incongruous device in which to kindle a fire.

Suggestions that an artist with experience in restyling metal products be secured to redesign the heater, so far as external appearance was concerned, resulted in retaining Walter Dorwin Teague to cooperate with the manufacturer's engineers. The result was the much more attractive product shown in Fig. 2. One aim in redesigning the heater was to gain the appearance of solidity. Instead of using an overhanging top which revealed the thin sheet steel, the top was recessed as shown, and a simple but inexpensive chromium-plated stock molding was employed to cover the joints in the metal sheet exterior. In addition, the doors in front were redesigned to look as if intended for a heater. They were also recessed and the opening was trimmed with a simple molding in such a way as to give the impression of a thick and solid wall. The legs were also cast in box section rather than in an angle section, and were provided with dome-like leveling feet. In place of the rather expensive vitreous enamel finish formerly used, the case was given an attractive damaskene finish not subject to chipping. This was much more appropriate than imitation wood and also served to set off the bright chromium trim.

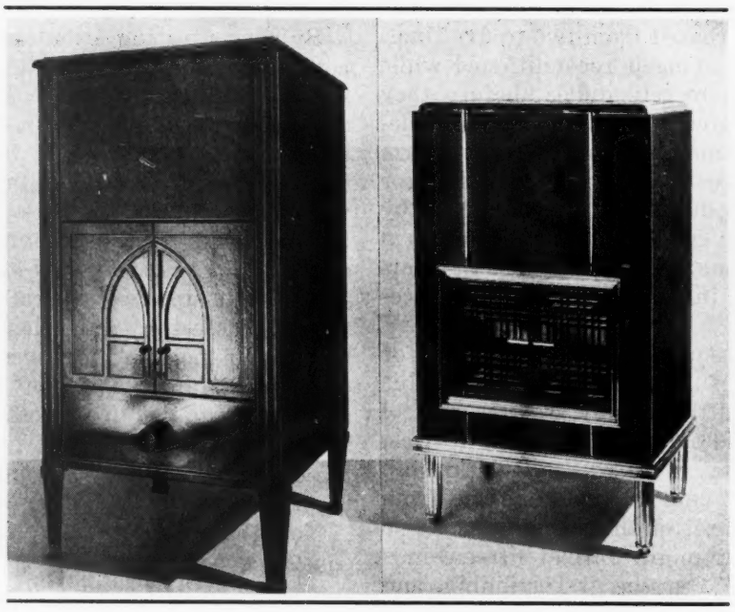


Fig. 1. A Heater in the Form First Marketed by the American Gas Machine Co. In Shape and Finish, it is Similar to a Wooden Phonograph Cabinet, an Inappropriate Type of Enclosure for a Fire

Fig. 2. A Similar Heater Redesigned by an Artist. The Dark Lacquer Finish Contrasts Pleasingly with the Chromium-plated Moldings. This Design Outsold the Earlier One about Four to One

Although made to sell at approximately the same price as the old heater, the new product looked so much better as to place it practically beyond competition. It now sells, in fact, largely on an appearance basis and without the need for explaining mechanical features which neither the average store salesman nor the average purchaser is likely to appreciate readily. According to the general sales manager, sales have increased no less than 400 per cent, assuring capacity production in a large plant. Such results are not always gained, of course, but they serve to indicate what can be accomplished when an artist works in cooperation with mechanical designers.

Another example of the benefits derived from providing a new dress for an old product is shown in the watch illustrated in Fig. 3. Features were added in this instance which not only increased convenience, but opened up a new outlet for the product, which originally was "simply another dollar watch." The change came about when an artist with Industrial Design, Inc., observed that some women

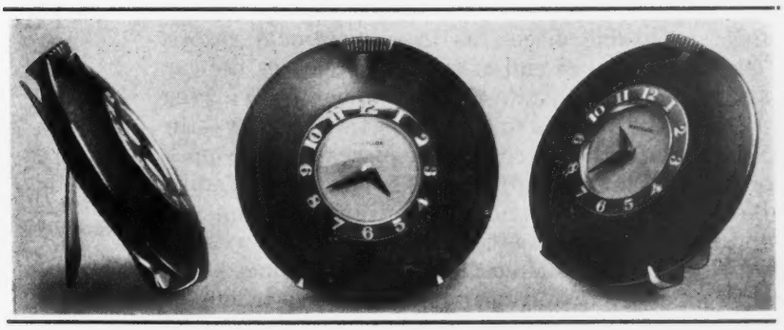


Fig. 3. Handbag Watch Produced by the Western Clock Co. to the Designs of an Industrial Artist. In its Molded Plastic Case, with the Stamped Easel, this Feminine Adaptation of a Man's Dollar Watch has Enjoyed a Good Sale at a Profitable Price

carried men's watches in their handbags, perhaps because they are inexpensive, easy to locate, and more dependable than some smaller watches. The aim of the new design was to give the product a feminine appearance (it is about the size and shape of a conventional vanity case) and make it suitable also for use on a table, as well as for carrying in a bag. The watch was therefore enclosed in a black Bakelite case, smooth, light, and tight, with an opening for the watch face. Into this opening was pressed a gold-plated bezel bearing embossed numbers. A stamped metal easel for supporting the watch in the position shown was added. This product has made an instant appeal to women; 20,000 were sold before the first production run was completed, and another 20,000 have been put into production. The assembly retails for $2.95. Simplicity is characteristic of this design, as of most successful product designs of today.

The new General Electric Hotpoint food mixer, Fig. 5, is another example of good but simple design, the exterior appearance of which was worked out by Laurelle Guild, another artist who specializes in the design of industrial products. A graceful but substantial appearance was achieved, and one that fits well in almost any kitchen. With the motor in the base of the column, driving by a flexible shaft to the head, the center of gravity is low and the head can be swung about the pivot without danger of upsetting. Zinc die-castings form the smooth and easily cleaned housing, which is finished in green baked enamel. Data on sales are not yet available, but there seems to be little doubt that attractive appearance and convenience will again prove exceedingly helpful.

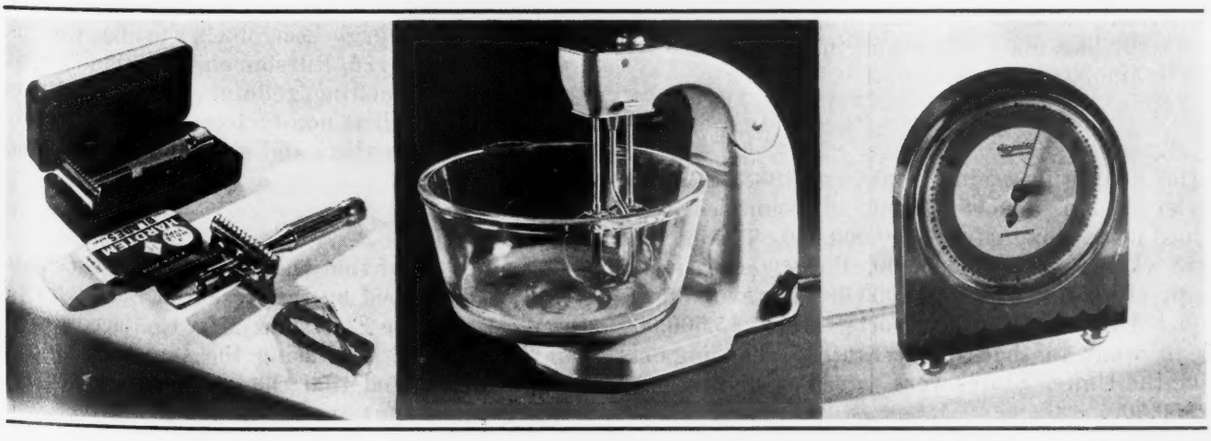
Fine appearance—the result of good basic design—and convenience are contributing to the sale of the Airguide thermometer, Fig. 6, a product of Fee & Stemweld, Inc. A neat but very simple die-casting of zinc alloy, chromium-plated, with a large dial which is much easier to read than a mercury thermometer, are factors responsible for the ready sale of this product in a market where there is plenty of competition. Without these assets, it would be "just another thermometer."

Another field in which competition is keen is that of the safety razor, but again good design, from the standpoint of appearance as well as utility, and originality in promoting convenience have made the two razors shown in Fig. 4 successful. In the Heppenstall razor, shown in its box, three zinc die-castings are combined into what becomes for the

Fig. 4. Two New Designs of Die-cast Zinc Safety Razors in which Convenience and Attractive Appearance Add to the Sales in a Field where Competition is Keen

Fig. 5. Hotpoint Food Mixer—a Substantial but Graceful Design Worked out by an Industrial Artist in Cooperation with Engineers of the General Electric Co.

Fig. 6. An Unusual Design of Thermometer with a Die-cast, Chromium-plated Case. Sales are Increased by the Pleasing Appearance and the Ease of Reading



user a two-piece assembly, instead of one having three separable pieces, as in conventional razors. Turning the large end of the stem releases the cap and blade and permits of adjustment for varying degrees of closeness in shaving. In the other—the Segal razor—there are no loose pieces to be dropped or lost, and shaving adjustment is also made readily. Both products are well designed and well finished and both possess the attractive appearance without which sales would almost certainly be reduced.

From these and from numerous other examples that might be cited, it is evident that a design which is basically good from an artistic standpoint and which is in keeping with the purpose to which the product is applied and with the surroundings in which it will be used is a most important consideration from a sales angle. Not all engineers and others in factory organizations charged with product design, however, possess the knowledge of artistic requirements necessary to achieve the beauty of line and form that are being demanded today; but there are many industrial artists who can cooperate with factory organizations to achieve the desired results. Many such are listed by the National Alliance of Art and Industry, New York City, and by other organizations of artists. Many of these artists possess an excellent knowledge of production limitations, and in other respects are well equipped to cooperate with the engineer. The latter should seek their help, as in so doing, his own efforts have a much better chance of commercial success.

Although the need for beauty applies especially to certain classes of objects, such as are intended for domestic use, it should not be overlooked even in machines and equipment for factory and commercial use. An attractive machine, designed with due regard for the use to which it is to be put and in such a way as to fit into its surroundings, will often stand out as an object of beauty, and in all cases has a better chance of sale than its equivalent of ugly or indifferent appearance.

This is a day in which appreciation of the artistic product is increasing rapidly. Designers who ignore this fact place a handicap on their own work, as well as upon the organizations they serve. In addition, features of originality and convenience must not be overlooked. The designer should take every opportunity to learn how and why purchasers like or do not like his product and in what respects it can be improved.

* * *

During the first nine months of 1933, the total Soviet Union imports from all countries were valued at approximately $140,000,000. The exports were valued at $185,000,000, thereby creating a credit abroad of about $45,000,000 in favor of the Soviet Union. Of the exports, about $5,500,000 worth went to the United States. The imports from the United States were valued at slightly over $7,000,000.

The Teaching of Mechanical Drawing

By J. HOMEWOOD

In the August, 1933, number of MACHINERY (page 768), it was pointed out that many engineering schools are not placing sufficient stress on the fundamentals of mechanical drawing. In my opinion, engineering schools should assume the attitude that the student who is entering has no knowledge of the subject whatever, even though he may have taken it up in high school.

This statement is not intended to throw any reflection on the high school instructor. He has to cover a certain amount, so to speak, within a specified time, using forced draft with poor fuel. For the last ten years, it has been my duty to teach the fundamentals of drawing in a high school. I have endeavored as far as possible to impart these fundamentals in such a manner that they might become an asset to the student, whether he is to become an engineer or not, because among high school students there is a surprisingly small percentage who will enter the field of engineering.

The minds of the average high school students react in various ways: Some actually think; some perspire in an effort to do so; and some just don't care whether Columbus discovered America or Patagonia. It is the high school teacher's problem to so instruct his class that he will do the most good to the greatest number; but, even though he does his very best, it cannot be good enough for an engineer. It is the duty of the engineering school to deal with the subject as it should be dealt with for specialists in engineering. To use the expression employed in the article referred to, the engineering student must be taught "the language of the engineer."

* * *

Small Arc Furnace for Laboratory Work

In the past, no arc furnace smaller than a 50-pound size has been available for high-temperature metallurgical work. In many laboratories a 25-pound size would, however, prove useful. A furnace of this size has, therefore, been placed on the market by the Pittsburgh Lectromelt Furnace Corporation, P. O. Box 1125, Pittsburgh, Pa. This furnace can be used for melting, refining, and alloying irons and steels, as well as non-ferrous metals and alloys, and for ore reductions and other laboratory work.

* * *

A timing motor that will revolve only twice a day has been developed by the Research Laboratory of the Westinghouse Electric & Mfg. Co., according to *The Locomotive*. By using the same principle of design, it is stated that the speed can be brought down to as little as one revolution a year.

A Year's Progress in Machine Shop Practice

A Review of the Outstanding Trends in Shop Practice and Machining Methods During the Past Year

THE Machine Shop Practice Division of the American Society of Mechanical Engineers, at the annual meeting of the Society, presented a report pointing out the important developments in the machine shop practice field that have taken place or gained additional impetus during the past year. The following paragraphs are abstracted from this report:

Progress in machine shop practice during the last twelve months has been characterized by basic radical changes in thought and procedure—changes that have come to stay and that are meeting the acid test of commercial usage under highly competitive conditions. There is a tendency on the part of a number of the larger users of mechanical equipment to deviate from the long established practice of regarding each productive unit in the line as a more or less independent, individual problem. The tendency now is to resurvey the operations of the production line as a whole when any question arises affecting redesign of product calling for reprocessing. That the philosophy underlying this change is sound in conception has been demonstrated by reduced costs of production and the application of the principle to other line-production activities.

The machine tool industry, like all capital-goods industries, has been an acute sufferer from the depression; but with the engineering industry as a whole faced with shorter hours, higher rates of pay, and more keenly competitive conditions, the elements of high-quality product, coupled with low cost of production, dependent on good machine tool equipment, stand out like sign-posts indicating the road that must be followed.

Advances in Precision Grinding and in Broaching Practice

Radical changes in the design of automobile parts, such as camshafts and crankshafts, have led to the development of precision grinding machines of a size, power, and range hitherto considered impractical. While the principle on which the new tools operate is unchanged, the outstanding characteristic of this development is the evidence of a new boldness of attack in the attempt to completely machine, at one chucking and one tooling, parts that hitherto required several chuckings and several tooling applications.

Probably the most outstanding development in new machine tools is the application of external broaching to the shaping of many parts which, it was previously believed, could only be machined on the planer, milling machine, or lathe. That the new process has many attractive features is demonstrated by the fact that those who have already made installations are anxious to extend the practice to other components in their line.

In a few instances remarkable economies have been achieved by the application of this relatively new process, but as is the case with all machine tool equipment, it is impossible to generalize and at the same time be accurate; hence reference to progress in external broaching as a machine shop method must be confined to the statement that in some applications it has shown remarkable results.

Report of Cutting of Metals Committee

The Sub-Committee on Metal Cutting Data has been active during the past year in obtaining information from tool-steel manufacturers and users with respect to the relative amount of tool steel used in metal-cutting operations. The result of this survey indicates that over 90 per cent of all machine work is being done with high-speed steel rather than with the newer cutting materials.

Some work of major importance has been done in the field of drilling, especially in the development of drills and equipment for drilling deep holes of small diameters in steel. This has been accomplished by using drills having a spiral angle of about 40 degrees, instead of the customary 22 to 30 degrees, and by the use of hydraulic-feed mechanisms arranged to remove the drill rapidly from the hole several times during the operation, so that the chips can be washed away by the cutting fluid. Drills of this type have been made in sizes from 1/8 to 1/2 inch. They have been found advantageous also when used in automatic screw machines.

For the drilling of small holes in non-ferrous metals, tool-steel drills are now available in sizes as small as No. 60, which can be fed at feeds seven times as great as those generally used for holes as deep as six to eight times the drill diameters.

Improvements in Foundry Practice

Under the urge of competing materials and processes, the cast-iron founder has made more developments during the last two years than has been

the case for many years previously. These developments have been obtained largely through heat-treatment, alloys, carbon control, and melting methods. Through these means, high-test and special cast irons are being made, some with tensile strengths up to 80,000 pounds per square inch. Heat-treated alloy irons have shown some exceptional possibilities in such applications as automotive brake-drums, camshafts, and crankshafts. Alloy irons have been developed to withstand temperatures up to 1650 degrees F., as contrasted with plain irons which begin to "grow" at about 650 degrees F.

In the steel-casting industry valuable experience has been gained in the production of low-alloy steel castings. This has caused betterment in the melting and heat-treating procedures and in shop practices that are distinct from furnace operations. Also, the keen interest of many consumers in high-alloy steels in rolled and wrought form has been followed by striking developments in producing castings of similar metals.

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How the Goodyear Company Met the Depression

The six-hour day working plan now in effect in many industries was applied by the Goodyear Tire & Rubber Co. to provide employment for as many people as possible over three years ago. Under this plan the Akron plants alone were able to provide employment for more than 3000 workers who would otherwise have been unemployed. It is true that the incomes of all workers were reduced, but they were able to provide the necessities for themselves.

All workers are employed on six-hour shifts. During the worst of the depression last March, all employes worked three days of six hours each per week. As business improved, they worked four, five, and finally six days each week—six hours a day. When everybody was employed six days, six hours a day, the company began to add to its factory personnel. At the height of the summer season the plant operated four six-hour shifts a day, six days a week. If the eight-hour day were adopted, some 3500 workers would be unemployed.

* * *

Steel Binding Strip for Packing Cases

Steel binding strip material 1/2 inch wide which can be furnished with the manufacturer's or dealer's name or brand marked upon it in brilliant contrasting colors has been developed by the Stanley Works, New Britain, Conn. Shipping cases bound with this material, which is known as Stanley "Pilferstop" steel binding, cannot be tampered with without detection. Thus, the binding strip serves as a strong reinforcement for the packing case, an attractive advertising medium, and a protection against pilfering.

Eightieth Anniversary of Mitts & Merrill

The firm of Mitts & Merrill, Saginaw, Mich., was founded by George W. Merrill in May, 1854, and this year will celebrate its eightieth anniversary. George W. Merrill continued as sole proprietor until 1873, at which time a partnership was formed between S. S. Mitts and William Merrill, the latter being a son of George W. Merrill. The firm was then known as Mitts & Merrill. This partnership was continued until 1904, when the firm of Mitts & Merrill was incorporated under the laws of the state of Michigan.

The present machine shop is on the exact site of the original plant, which consisted of a small machine shop and foundry, where a general foundry, machine shop, and repair business was carried on by the founder. This was in the early lumbering days of Saginaw Valley, and much of the work was in connection with sawmill and marine repairs. Also, at a very early date the plant was engaged in the manufacture of quite an extensive line of agricultural machinery, such as drags, harrowers, plows, stump pullers, etc. In addition, the plant manufactured various types of equipment for the sawmills.

In 1886, Mitts & Merrill took on the manufacture of hog machines, and these, together with chippers, shredders, and the well-known "Giant" keyseater, the manufacture of which began in 1894, constitute a large part of the production at the present time.

The officers of the corporation are: President, M. H. Stimson; vice-president, Otto Schupp; treasurer, R. Perry Shorts; secretary, Emil Tessin. The plant superintendent, William J. Winston, is now serving his fifty-first year with the compay.

* * *

New Floor Resurfacing Material

A new type of floor repair material which is said to have many advantages over old-fashioned methods of repairing worn or broken factory floors, trucking aisles, and platforms is known as "Stonhard Resurfacer" and is made by the Stonhard Co., 401 N. Broad St., Philadelphia, Pa. The material is mixed with sand and cement, and the mortar is laid cold about 1/2 inch thick. It can be bonded to concrete, wood, brick, wood-block, asphalt, or composition floors, and is ready for use thirty-six hours after being laid. It is stated that this type of flooring is not noisy like other hard floor materials.

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We see governments resorting to a merciless taxation of the products and processes of industry and trade to raise funds, not for the better development of production and distribution of wealth, *but for the reduction and destruction of production.*—*Stephen Bell in Commerce and Finance*

Flanged Precision Ball Bearings Applied to Machine Tool Spindles

A New Arrangement of Spindle Mountings to Insure Rigidity and Accuracy—Typical Examples from the New Departure Mfg. Co., Bristol, Conn.

By CHESTER B. LORD

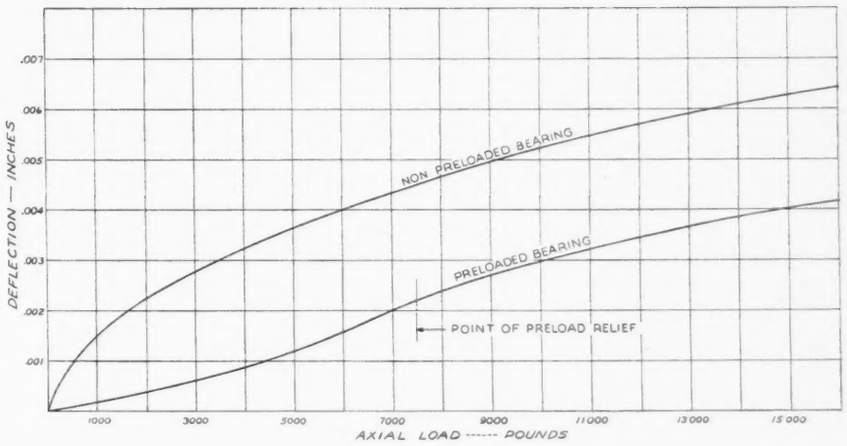


Fig. 1. Diagram Illustrating the Point of Preload Relief in Relation to Axial Load and Deflection in Ball Bearings

A FEW years ago machine builders were faced with the demand for greatly increased spindle speeds due to new discoveries in cutting tools. This necessitated a wider use of anti-friction bearings and provided a stimulus to bearing engineers, who devoted much time to research work. The causes and effects of deflection were thoroughly investigated as a basis for establishing greater spindle rigidity. Preloading was reduced to a fine art. Bearing spacing, lubrication, expansion and contraction of machine elements, and numerous other topics occupied the attention of designers and laboratory men.

A great many types of spindle mountings were devised, the principal differences being in the methods employed for preloading the bearings. Some machine builders utilized spacers, others relied upon springs, while still others used the manually preloaded spindle. All of these types have been successfully employed and all machine builders are now more or less familiar with the advantages and disadvantages of each. The flanged precision bearings recently announced present a considerable advance over those previously built. The reasons for this improvement will be clear from the description of their design and application.

Advantages Claimed for the Flanged Type of Bearing

Briefly, the flanged precision ball bearings are single-row, angular-contact, separable bearings having a flange formed on the non-thrust side of their outer race rings. Their design has the following advantages: (1) Flanges on the bearings eliminate the need for inside shoulders in the machine housings. (2) Housings can be bored and ground straight through as plain cylindrical holes, which reduces set-up expense and insures true alignment and accuracy. (3) Machine assembly or disassembly is greatly simplified, because the bearings are made separable—that is, so that

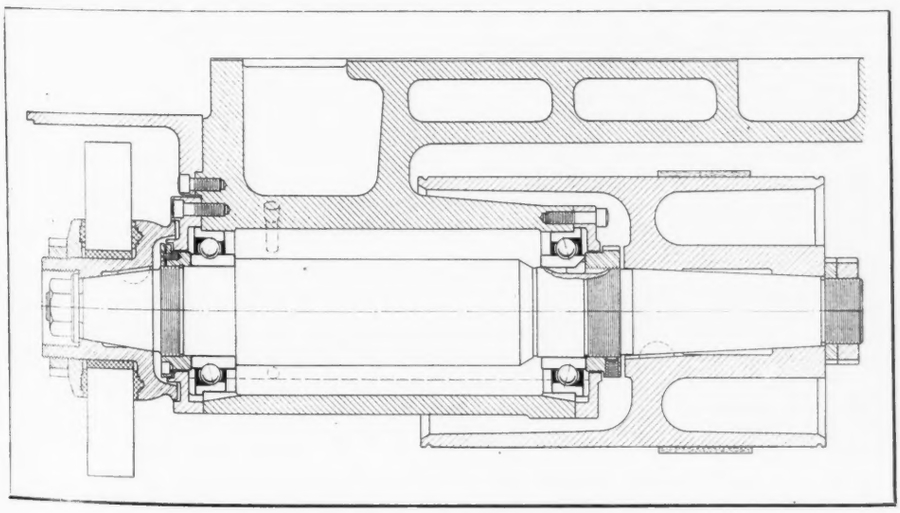


Fig. 2. Grinding Machine Spindle with Flanged Ball Bearings

the outer rings can be removed from the inner ring and bore assemblies and applied as individual units in the housing. (4) Numerous parts hitherto necessary to the preloading operation are no longer required, because the flanged bearings are preloaded through one bearing inner ring by a single nut on the spindle.

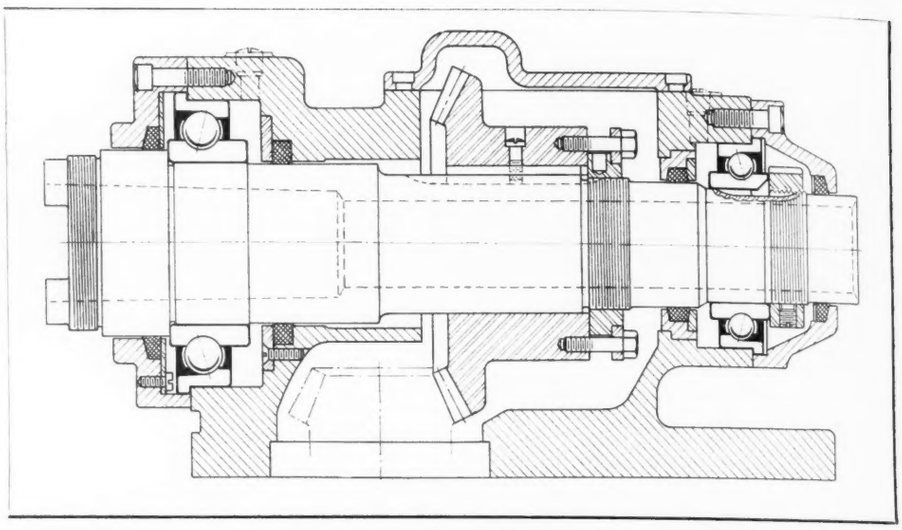


Fig. 4. Spindle of Milling Machine Attachment, Showing Spindle Mounting

The New Flanged Bearings Are of the Angular Contact Type

Rigidity, accuracy, and speed are the three prime requisites of the modern spindle. Rigidity here means rigidity under all loads—that is, radial, thrust, or any combination of the two. Since a ball bearing resists loads along its line of ball contact, the greatest resistance to deflection is offered to loads having an angularity approximately equal to the internal contact angle of the bearing. Although work loads may vary from 0 to 90 degrees in angularity—that is, from pure radial to pure thrust—by far the majority of machine tool spindle loads are grouped within a comparatively small range in so far as their angularity is concerned. The flanged precision bearings have, therefore, been designed so that their contact angle gives the greatest resistance to deflection resulting from loads applied within this range of angularity.

Although preloading has been the subject of various articles in the past, it is advisable here to restate a few of the principles involved. Hookes' law states that strain is proportional to stress. The value of preloading and the exceptional results obtained with ball bearings lie in the fact that Hookes' law does not apply to deformation in a ball bearing assembly. This is because of the relative curvature of the balls and their raceways. Stated as simply as possible, when a given load is applied to a ball bearing, a certain deformation occurs in the balls and races, resulting in a definite area of contact between the two, the magnitude of the stress depending upon the size of the contact area. If this load is increased 100 per cent, the stress in the bearing is increased very much less than this, owing to the fact that the contact areas increase in size at a much greater rate.

From this, it is plain that if a certain load produces a definite deflection in a ball bearing, subsequent increases in the load will be attended by a continually decreasing rate of deflection. Without going further into the subject of preloading, the actual advantage of a preloaded bearing over a non-preloaded bearing may be observed by reference to the curves in Fig. 1.

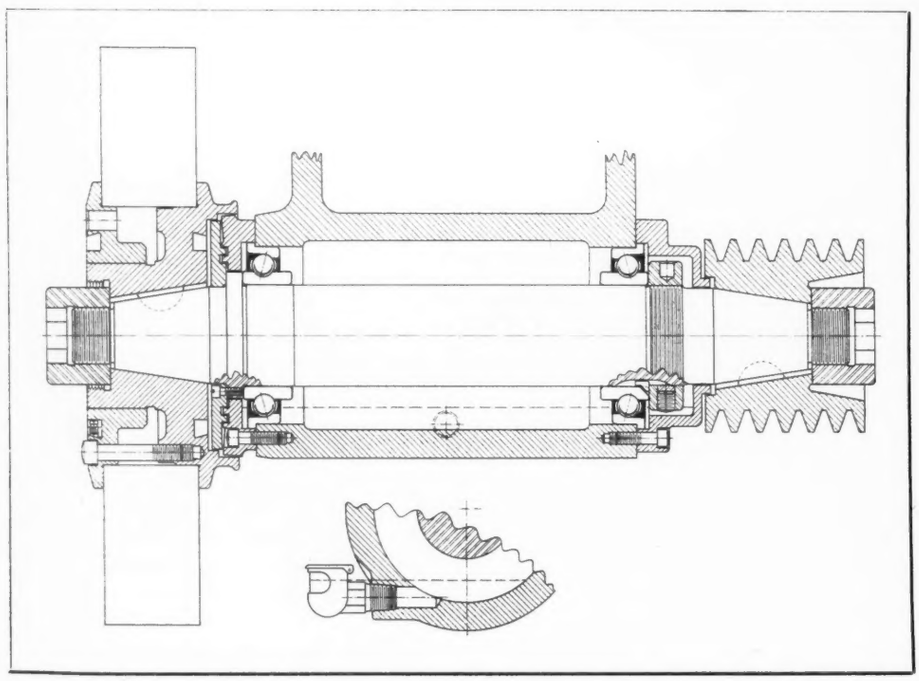


Fig. 3. Another Example of a Grinding Machine Spindle Mounted in Flanged Ball Bearings

The contact angle of the flanged bearing is such that very heavy preloads are not required to obtain a high degree of rigidity. An external, or work load, must be approximately four times as great as the preload, in order to entirely relieve the bearings of the preload. Also it is important to observe that when the preload on a set of bearings is entirely relieved, due to an external load, the deflection is still a great deal less than would be the case if the bearings had not been preloaded. The point of preload relief is indicated on the curve in Fig. 1 to illustrate this condition.

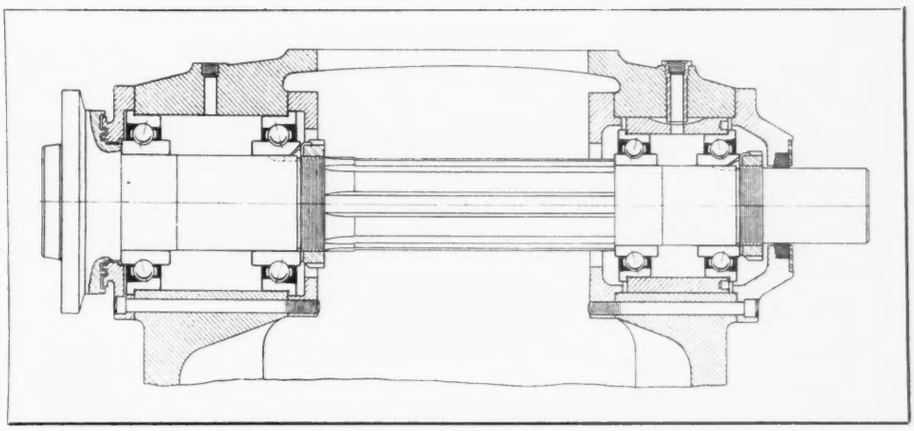


Fig. 5. Typical Mounting for a Long Spindle

The Application of Flanged Precision Bearings

Where great accuracy and rigidity are essential, anti-friction bearings must be so fitted as to obviate any possibility of radial play between the bearing rings and the housing or between the rings and the spindle. This means that press fits are a necessary part of the mounting, and this complicates assembly and disassembly, unless the bearings themselves are made separable, which is the case with the bearings under discussion.

It is necessary, of course, to provide one relatively loose fit where assembly ends or disassembly begins. Otherwise, a separable bearing would be rendered inseparable by tight fits. Therefore, in these flanged bearings the inner ring of the bearing at the rear of the spindle is applied with a line-and-line fit, and it is through this member that the preload is applied. The inner rings of the flanged bearings, however, are made extra wide, and if correctly fitted, provide such a long seat on the spindle as to prevent cocking or deflection, particularly at the rear bearing position where the loads ordinarily are lighter.

Although a ball bearing inner ring made extra wide and fitted closely as a line-and-line fit would not creep to such an extent as a narrow or more loosely fitted ring, some relative movement would occur; to prevent this, the flanged bearing inner rings are provided with key-slots, so that they can be locked against rotation about the shaft.

To widen the range of application and to facilitate incorporating them in machine designs, the flanged bearings are made in two bore sizes for each outside diameter, thereby allowing them to be applied in housings bored straight through with the same diameter, but permitting a step-down in spindle diameter.

The grinder spindles, illustrated in Figs. 2 and 3, employ a rigid one-piece housing in which the machining advantages offered by the flanged bearings are fully utilized; that is, the housings are so designed that they can be bored straight through from either end at one set-up, thereby assuring a minimum runout and the best possible alignment. It will be observed that the housing closure members at each end are located radially on the outside diameter of the bearing flanges. This is desirable practice, since the flange diameter is ground accurately enough to locate the closures concentric with the spindle. In the spindle shown in Fig. 3, the shaft is straight—that is, there is no decided step-down. Actually, however, since the forward bearing inner ring is press-fitted, there is a slight difference in diameter at the rear to give the required line-and-line fit for the rear bearing inner ring.

Fig. 4 illustrates the spindle for a milling machine attachment in which the housing is not bored straight through. However, this is not done to form integral housing shoulders, but because it is necessary to separate the bearings from the gears by means of oil seals. It is recognized that it is impossible to keep a certain amount of foreign matter from the gear oil, and since this matter, in the form of metal chips or small particles of dirt, would enter the ball races and impair the accuracy of the spindle somewhat, such closures are deemed advisable. However, the axial location of the bearing is determined by means of the flanges, and the extreme ease with which the bearings can be preloaded through the relatively small nut at the rear is readily apparent.

The Application to Long Spindles

With the increasing use of ball bearings for precision spindles that has taken place within the last few years, the tendency has been away from long spindles to those much shorter and more rigid. Whenever new machines are designed, the use of very short, heavy-sectioned spindles is extremely desirable, not only from the point of rigidity, but also because of the general machine compactness obtained. In some types of machine tools,

it is difficult to shorten the spindles as much as might be desired, and it is sometimes necessary to use four bearings to prevent spindle deflection.

The design shown in Fig. 5 is quite typical of such a mounting. The two front bearings are mounted directly in the frame and are preloaded in the same manner as for the ordinary two-bearing mount. The two rear bearings, on the other hand, must be applied in such a manner as to permit expansion of the spindle or of the housing without throwing serious loads on the bearings. For this reason, the rear bearings are placed in a relatively heavy sleeve which, in turn, is closely fitted in the frame. The advantage of preloading through the bearing inner rings is particularly obvious in this mounting, since even though there are two sets of bearings to preload, this can be accomplished quickly and accurately by means of the two nuts; and the preloading can be varied at any time.

Although the mountings shown do not illustrate all of the possibilities in machining and bearing installation, the writer believes that they clearly indicate the important part in machine design that flanged precision bearings are destined to play.

* * *

Electric Welding in Railroad Practice

During the past year, an electrode has been developed especially for building up battered rail ends by electric welding, according to John Liston of the General Electric Co. The deposited weld metal is tough and hard immediately after deposit. This hardness is further increased by the cold-working which results from the passage of traffic over the weld.

The practice of welding battered rail ends is important to railroads, due to its economy, as the ends may be rebuilt many times if necessary by arc welding until the ultimate life of the rest of the rail is reached.

The self-propelled tractor-type of arc welding equipment has been found to be well fitted for maintenance-of-way work on railroads. It consists of a tractor upon which are mounted either one or two single-operator arc-welding generators with their control.

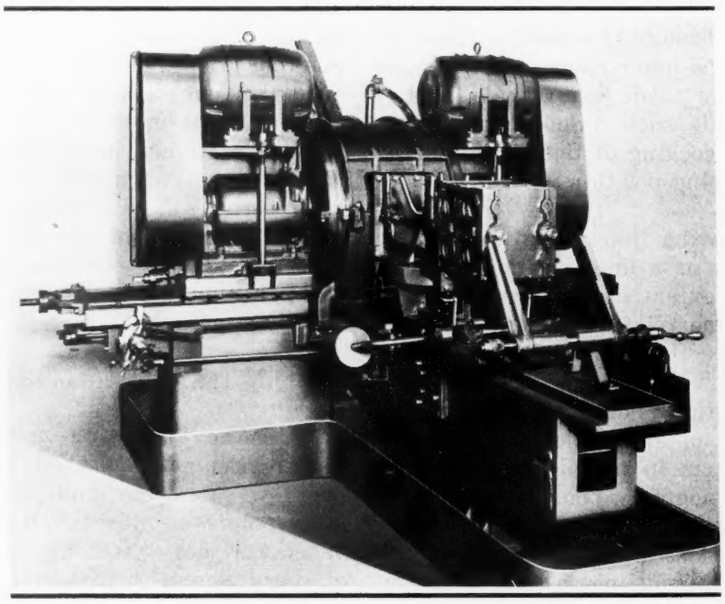
Grinding Coil Springs for Automobile Front Wheels

Great interest was shown at the recent automobile shows in the new type of independent spring suspension that has been adopted for the front end of some of the 1934 cars. This construction is the first breaking away from the semi-elliptic spring suspension that has been standard for many years. The large coil springs used in the new type of construction must be ground on both ends to insure parallelism and to provide a flat seat over 75 per cent of the area of each end. Also, the ground ends must be held square with the axis within 1/2 degree.

Several large double-spindle machines have been built by the Gardner Machine Co., Beloit, Wis., for grinding these coil springs to the specifications mentioned. One of the machines is shown in the accompanying illustration. These machines have been equipped with 26- or 30-inch grinding wheels and with a hydraulically operated oscillating table on which an indexing type of fixture is mounted. Both ends of the fixture accommodate either two or four springs, depending upon their size and production requirements. While one end of the fixture is being oscillated between the grinding members, the operator reloads the other end.

During the oscillation of the work, the grinding wheels gradually close until the springs have been ground to a predetermined length. This in feed is not a continuous movement, the wheels closing in a few thousandths of an inch with each oscillation of the work. As the oscillation of the table is automatic, the operation is practically continuous.

The coil springs ground by the machine illustrated are 12 1/2 inches long and 4 3/4 inches outside diameter, and are made of 11/16-inch wire. They are ground at the rate of 150 springs an hour. About 3/32 inch of stock is removed from each end.



Coil Springs for Automobile Front Wheels Must be Ground on the Ends for Parallelism, for Squareness, and to Give Proper Seating Area

* * *

It is reported from Germany that the fastest electric train in the world has been put in service between Munich and Stuttgart, a distance of 149 miles. This distance is covered at an average speed of 89 miles an hour. Seventeen electric locomotives for similar service are on order.

The Production Possibilities of External Broaching

Whenever a new machining method finds favor, manufacturing executives throughout the metal-working industry want to know whether the method could be applied to advantage in their own shops. Definite information concerning costs and quality of finish is, however, generally hard to obtain at first, and so the average manufacturer does not know how to answer this question until the practice has been fairly widely adopted or experiments have been made in his own shop.

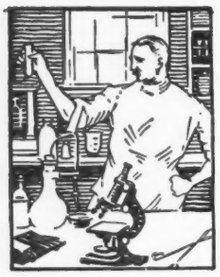
Strictly speaking, external or surface broaching is not new, but this machining method is receiving much greater attention than in the past and it has recently been adopted for the finishing of many parts. This is especially true in the automobile field.

In order that executives unfamiliar with the production possibilities of external broaching may know what is actually being done by this process, a table is here reproduced from a paper presented before the annual meeting of the Society of Automotive Engineers by Joseph Geschelin, Engineering Editor, *Automotive Industries*. This table lists a number of standard automobile parts, the materials from which they are made, the nature of the operation, the production obtained per hour by broaching, the average number of pieces that are produced per grind of the broaches, the type of broach employed, the total amount of stock removed by the broaching operation, typical tolerances specified, and the cutting speed in feet per minute.

Production Data on External Broaching Operations in Automobile Plants
(From a Paper by Joseph Geschelin before the Society of Automotive Engineers)

Part	Material	Operation	Hourly Production	Pieces per Grind	Type of Broach	Stock Removed	Tolerance, in Inches	Cutting Speed, Feet per Minute
Shift Rail	Steel	Three Slots	200	1500	Pull	—	—	—
Shock Absorber Wing	Steel	Comp. Profile	200	1200	Pull	—	—	—
Clutch Lever	Steel	Two Cam Surfaces	300	2000	Push	—	—	—
Clutch Disk	Cast Steel	Lug Profile	275	2000	Push	—	—	—
Differential Case Pin Bearing	Cast Iron	Semicir. Bearing	60	800	Pull	—	—	—
Steering Support Arm	Mall. Iron	Serrations	200	3000	Serrated Pull	—	—	—
Connecting-rod	Forging	Facing	200	1500	Double Face Pull	—	—	—
Connecting-rod	Forging	Slitting	200	1500	Pull		—	—
Gear Sector	Cast Iron	Gear Teeth	225	3500	Pull	—	—	—
Steering Sector	Steel	Gear Teeth	175	1200	Push	—	—	—
Clock Base	Zinc Die Casting	Surface	350	5000	Push	—	—	—
Crankshaft Bearing Cap	Cast Iron	Finish Joint Face and Ends to Size	398	31,500	Vertical Push	0.621 cu. in.	—	24
Crankshaft Bearing Cap No. 4	Cast Iron	Step for Gasket	772	35,000	Vertical Push	0.221 cu. in.	—	18
Connecting-rod	Forging	Faces Large End	490	21,600	Vertical Push	0.087 cu. in. (2 caps)	—	22
Cylinder Block	Cyl. C.I.	Four Bearing Cap Surfaces	112	7000	Horizontal	1.710 cu. in.	—	25
Motor Rotor Hub	Steel	Four Segments	65	5000	Horizontal Pull	—	—	—
Bearing Cap	Cast Iron	Slot Face	480	—	—	—	—	—
Shock Absorber Wings	Molybdenum Steel	Broach Radii	550	25,000	Horizontal Pull	0.600 inch on side	0.0005	—
Universal Joint Rings	Forging	Four Cross-holes	600	25,000	Vertical Push	—	—	—
Connecting-rod	Forging	Bolt Boss Contours	700	—	Horizontal Pull	1/32 to 1/16 inch	0.0005	—
Speed Reducer Rings	Cast Iron	Deep Radial Slots	14	4000	Horizontal Pull	—	—	—
Cylinder Block	Cast Iron	Bearing Pads	12	4500	Horizontal	0.032 inch	0.0005	—
Clutch Lever	Forging	Two Cam Surfaces	1800	—	Vertical Push	1/16 inch	—	—
Coarse Steering Sector	Forging	Roughing	325	60,000	Horizontal Pull	0.370 inch	—	—
Free-wheel Clutch	Forging	Outer Contour	150	—	Vertical	3/16 inch	0.0005	33
Free-wheel Cam	Tool Steel	Four Tongues	180	—	Vertical	0.20 inch	—	20
Connecting-rod	Forging	Big End Radius and Faces	360	—	—	1/8 inch	—	27
Steering Sector	Forging	Roughing 5 D.P. Teeth	600	—	—	0.410 inch	0.001 to 0.0005	33
Balance Weight	Forging	Two Operations: Inside Surfaces Outside Surfaces	225	—	Vertical	3/16 inch	0.001 to 0.0005	25

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Mercury and Mercury Vapor Do Not Affect This Alloy

Kovar is the name of an alloy that possesses the desirable property of having a thermal expansion that permits permanent sealing of the metal to glass. This alloy has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., for use as a wall in water-cooled electronic tubes.

Copper has also been successfully sealed to glass for such tubes, but when mercury is put into the tubes, the copper amalgamates and its strength is quickly lost. Kovar meets all of the usual requirements and, in addition, is unaffected by mercury or by mercury vapor.

New Uses of Materials in 1934 Automobiles

The most striking use of new materials in 1934 automobiles is found in the Ford V-Eight. This is the adoption of a cast-iron-copper-chromium-silicon crankshaft. The alloy contains only about 1 per cent carbon and therefore may be considered a steel. Its tensile properties approach those of steel forgings normally used for crankshafts, while its hardness and resistance to wear are somewhat greater. The Ford crankshaft is of a complicated design that was somewhat difficult to forge, whereas it can be cast with ease.

Camshafts of cast iron have been adopted for the DeSoto and Dodge cars; they were first used on the Terraplane last year.

Hudson cylinder blocks are now cast from a chromium iron.

The exhaust-valve seat inserts in the new Plymouth are made of an alloy cast iron.

Cylinder heads of an aluminum alloy are now regularly supplied on the Graham, Lincoln, Cord, Auburn, and Chrysler Custom Eight. They are optional on the Dodge. Composite aluminum and iron cylinder heads are obtainable on the Hudson and on the Terraplane.

Cadillac has been added to the list of automobiles equipped with pistons made from Lo-Ex high-silicon aluminum alloy.

On a number of cars, the babbitt bearings of connecting-rods have been replaced with bearings of a copper-lead alloy.

Stainless-Clad Steels are Used in Both Industry and the Home

Cooking utensils, shower-bath compartments, automobile artillery-type wheels, beer barrels, and milk-storage tanks are but a few of the many products now being made of IngOclad. This material, which is manufactured by the Ingersoll Steel & Disc Co., Chicago, Ill., consists of a sheet of mild carbon steel of substantial thickness, with a thin sheet of stainless steel welded to it. It combines the non-corrosive properties of stainless steel with the economies of carbon steel.

Chromium Steels that Stand Up Under High Temperatures

Steels with a chromium content ranging from 4 to 6 per cent have been developed by the Central Alloy Division, Massillon, Ohio, of the Republic Steel Corporation, for applications in which corrosion, acid attack, and scaling must be resisted at temperatures up to about 1150 degrees F. These steels are particularly adapted for use in oil cracking stills, where temperatures frequently run up to 900 or 1000 degrees F.

A position intermediate between common steel and stainless steels is occupied by these new 4 to 6 per cent chromium steels. They will rust much the same as common steel if subjected to a salt spray test or to alternate wet and dry conditions, but at a slower rate. They are more resistant to acid attack and scale less than mild steel at high temperatures. They can be rolled, formed, flanged, machined, welded, or worked the same as low-carbon alloy steels, provided certain precautions are observed.

The 4 to 6 per cent chromium steels are available in four different carbon ranges and with or without molybdenum or tungsten. The carbon ranges

are up to 0.10 per cent; from 0.11 to 0.15 per cent; from 0.16 to 0.20 per cent, and from 0.21 to 0.25 per cent. When molybdenum or tungsten is specified, the molybdenum content is from 0.40 to 0.60 per cent and the tungsten content from 0.75 to 1.25 per cent.

Deflocculation Reduces Graphite Particles to Minute Size

Graphite is a form of carbon that may have different physical properties with the same chemical analysis. In the natural state, graphite is mixed with mica, silica, and other foreign bodies. These are extremely difficult to remove, according to a bulletin issued by the Acheson Oildag Co., Port Huron, Mich. This concern produces graphite from commercial carbon at the temperature of the electric arc. During the process, the impurities are volatilized, leaving an extremely greasy product that is devoid of gritty substances.

The graphite then goes through a "deflocculation" treatment which reduces the particles to an infinitesimal size. Four hundred of these particles would be required, for example, to encircle a wire 0.0004 inch in diameter, such as is used for the filament of certain electric lamps. Aquadag colloidal-graphited water is used as a lubricant in drawing this wire.

Aluminum Foil Safeguards Meat During Transportation

Paradoxical as it may seem, aluminum, which is a good conductor of heat, has proved itself to be an excellent insulating material against radiant heat. This is because of the reflecting properties offered by its brightness. The use of aluminum for insulating purposes is facilitated by the fact that it can be rolled into sheets as thin as 0.00023 inch. Aluminum foil is made by the Alfol Insulation Co., Chrysler Bldg., New York City.

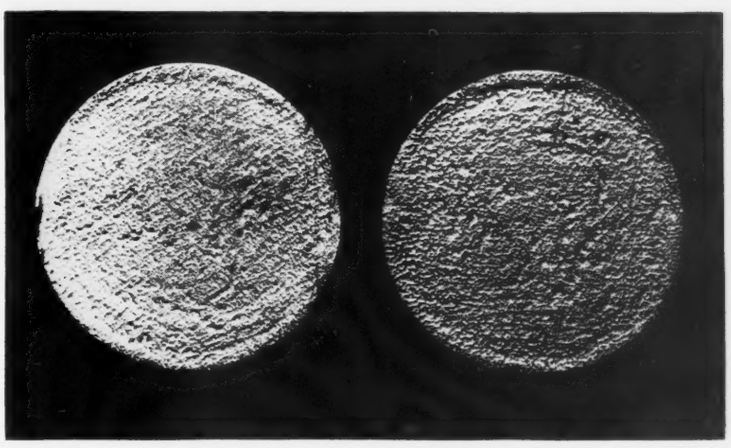
An interesting application of aluminum foil was recently made in constructing a truck for hauling meats a considerable distance. The gross weight of this truck, loaded and iced, was not to exceed 26,000 pounds. The chassis alone weighed 9100 pounds, leaving 16,900 pounds for the body, insulation, ice packing, and meats. It was specified that the aluminum foil should give insulating properties equivalent to 4 inches of cork. Two thousand pounds of cork would have been required for this purpose, whereas the aluminum foil necessary weighed only 30 pounds.

The body of the truck was also made of aluminum. It has one and two-thirds the capacity of a steel truck built six months previously, and weighs only two-thirds as much. The steel truck is insulated with cork and Kapok. Records of the comparative performance of these two trucks have been maintained. It was found that less ice is consumed in the aluminum-body truck than in the steel truck, because the heat flow through the walls, floor, and top is considerably less than through the cork and Kapok in the steel body. In one test made, 522 pounds of ice were loaded into both types of trucks. The steel truck did not reach the minimum temperature for 4 1/2 hours, whereas the aluminum truck reached the minimum temperature in 1 hour.

No One Knows When Cast Iron Was Discovered

Definite information is lacking as to when iron was first cast, but there are records of a bridge built in Japan in 70 A. D., which was provided with chains of cast iron. History records that pig iron was made in Europe—in the Siegerland of Westphalia—as early as 1311. The iron casting industry seems to have started in 1388, when it was discovered that iron could be successfully cast into cannon balls.

German records show that cannon were cast of white iron as early as 1414, and guns were cast in England before 1500. In Europe, at least, the cast iron industry appears to have had its birth in an early desire for more devastating instruments of warfare—a desire that seems to remain unsatisfied.



Two Photomicrographs that Illustrate the Advantages of the Non-destructive Magnetic Testing Method Used by the Union Drawn Steel Co., Massillon, Ohio. Both Photographs are from the Same Bar of Steel. The One at the Left would Indicate that the Bar was Perfect, but the One at the Right, which was Taken Only 18 Inches Farther along the Bar, Shows a Seam 3/16 Inch Deep. This Defect was Discovered by Merely Passing the Bar through a Test Coil. It was Cut at the Point where a Defect was Indicated by an Oscillograph

The Service of the Engineer in the Social Structure

From an Address by A. A. Potter, Dean of Engineering of Purdue University and President of the American Society of Mechanical Engineers for 1933

OUR times are distinctive, owing to the introduction of science and engineering in the everyday affairs of everyday people. Whether civilized man likes it or not, he is destined to live and to work in an environment affected to an increasing extent by science and technology. While some blame the engineer for the sufferings of our times, the fact is that scientists and engineers should really be credited with the delivery of humanity from the so-called Malthusian doom.

Whereas in past civilizations man had difficulty in producing enough to maintain himself above the level of mere existence, the engineer, by applying science to practical uses, assures an abundance of the world's goods for all, given only an effective mechanism of exchange. Present ills are not due to a lack of material wealth to satisfy human needs, but to our inability to distribute it rationally. However, our present problems, serious though they be, should not prove as difficult as those resulting from scarcity and want.

Also, it should be recognized that while the work of the engineer in improving methods of production has reduced employment in some specific cases, the engineer is primarily a creator both of wealth and of opportunities. By proper application of science he has created during the past 65 years, where nothing was before, such giant industries as those which manufacture automobiles, typewriters, radios, talking machines, airplanes, and telephones, as well as new utilities which are concerned with electric communication, electric transportation, and electric light and power.

These are creations, not developments. These are not displacing labor, but are adding new opportunities for profitable employment and happy careers for millions of people. It is reasonable to expect the engineer to develop new industries in the future as he has in the past, creating new opportunities, new jobs, and new careers. He knows what developments are needed and is able to direct the scientific researches and the manufacturing methods to produce results of value.

The engineer has contributed to the general welfare by reducing drudgery, by providing new entertainment, by saving time, and by increasing material possessions. His contributions are being fully appreciated, as to an increasing extent it is realized that America's predominant industrial position is due largely to the engineer.

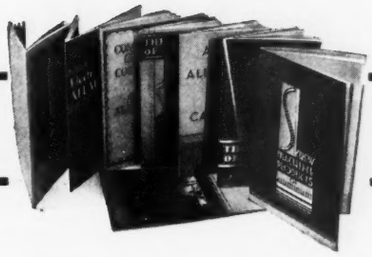
There is a general feeling, however, that he can make additional contributions by taking a greater interest in social and economic problems. Not that the engineer is a miracle worker who can bring about, through his own efforts, a perfect social order, but it is felt that, dealing as he does with facts rather than with opinions, he should be able to help with the social problems affecting us. He is skilled in the proper use of science and machinery and is in a position to forestall movements likely to hinder invention and discovery or retard the introduction of improved methods. He may even be able to contribute, by his straight thinking, to a better solution of the social and economic problems which at present confront us.

The engineer has substituted knowledge for guesswork in dealing with technological problems. Has he the wisdom to apply the same straight thinking in his dealings with human relations, social welfare, economics, and finance? It is to be hoped that we are now standing on the verge of a new and better epoch, a period during which the actions of engineers as individuals and as members of a great profession will be influenced still more by clear thinking and by true measurements, and less by irrational opinions, prejudices, and traditions.

Even though the engineer may not be able to solve, offhand, the problems of human organization, where supposed social experts have apparently failed, it is high time that he seriously consider them. Having developed the necessary technique for almost unlimited production of wealth, he can no longer afford to stand aside while financiers, promoters, and politicians so tragically bungle the problem of its distribution.

Primarily, engineering must deal with the technological problems of research, development, design, production, testing, and operation, yet the engineer is becoming more and more interested in finance and is to an increasing extent the directing head of industry and of public works; his success in financial, administrative, and executive posts may be attributed to his talents for dealing with the human phases of industry. He is beginning to interest himself in and to appreciate social and economic trends and is already taking his place among the leaders of our times. If the engineering profession is to maintain public leadership, the engineer must conscientiously dedicate himself to public service.

NEW TRADE LITERATURE



Any of these Publications can be Obtained by Writing to the Manufacturer or to MACHINERY. Send for Your Copy Today.

Roller Bearings

TIMKEN ROLLER BEARING CO., Canton, Ohio, has completed a valuable service to industry by the recent publication of a 266-page loose-leaf book—a new edition of the *Timken Engineering Journal*—which contains a description of the various types of Timken roller bearings and a fund of technical data covering ratings, load calculations, bearing selection, shaft and housing design, fitting tolerances, assembly methods, lubrication, and other information pertaining to the mounting, use, and maintenance of Timken bearings. In the present edition new load ratings have been established conforming to the fatigue life of the bearings. Statistical information covering the different types of bearings available is arranged in tabular form, according to the cone bore. The book has been compiled essentially for the use of engineers and machine designers.

Drill Chucks

JACOBS MFG. CO., Hartford, Conn. Catalogue containing information on Jacobs drill chucks. To simplify the selection of the right chuck for every purpose, a table is presented which shows at a glance the proper methods of fitting chucks to the machine spindle and recommends the proper chuck for each type of machine. Another table furnishes information regarding the interchangeability of all types of chucks, together with dimensions and price lists. The types of chucks listed include plain bearing chucks, ball bearing chucks, keyless chucks, positive drive chucks, single-purpose chucks, and lathe chucks. The book is provided with a thumb-index for convenient reference.

Cutter and Tool Grinding

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio. "Operator's Instruction Book for No. 2 Cutter and Tool Grinder." This is a complete instruction book, 60 pages, 6 by 9 inches, covering every phase of tool grinding as performed on the Cincinnati cutter and tool grinder. It is not a mere set-up instruction book, but is practically a complete text-book on the subject. In addition to covering general tool-grinding operations, it deals with the latest practice in the grinding of cemented-carbide tipped-blade milling cutters, of which a complete study has been made for the preparation of a section in this book.

Electric Equipment

IDEAL ELECTRIC & MFG. CO., Mansfield, Ohio. Bulletin 710, containing data on Ideal box and rack type capacitors for power factor correction. Tables are given for determining the right size capacitor for the correction of a low power factor condition in practically any plant. Complete details of construction of Ideal capacitors, together with dimensions and weights, are included.

MARBLE-CARD ELECTRIC CO., Gladstone, Mich. Catalogue covering the Marble-Card line of "Super Service" electrical machinery, which includes electric motors, generators, motor-generator sets, and rotary converters.

Motor Drive Bases

ROCKWOOD MFG. CO., Indianapolis, Ind. Folders covering current developments in Rockwood pivoted motor drive bases. One folder gives data on the ceiling drive base for mounting motors overhead; another, on standard drive bases for various motor ratings; a third, on the vertical drive base, so designed that the belt tension can be readily adjusted for any load; a fourth, on bases for small motors; and the fifth, on the Rockwood drive truck, a portable motor outfit suitable for use in maintenance departments.

Flexible Couplings

POOLE FOUNDRY & MACHINE CO., 3701 Clipper Mill Road, Woodberry, Baltimore, Md. Catalogue 34 on flexible couplings, containing all essential information for the design, installation, replacement, etc., of the different sizes and types of couplings made by this concern. The data presented includes information on the construction and operation of the clutches and a section of engineering data giving horsepower ratings, maximum speeds, dimensions, oil capacity and weights. A number of designs and types of couplings are shown that have not heretofore been listed.

Welding Equipment

METAL & THERMIT CORPORATION, 120 Broadway, New York City. Booklet entitled "Thermit Welding —Industry's Master Maintenance Tool." The booklet describes the Thermit welding process, which has been used for many years in welding heavy sections of ferrous metals, particularly in the street railway and railroad field and in the repair of large machine parts. Particular attention is given to the economy and permanency of Thermit repairs, and actual cost data are included in a number of instances.

Lubricants and Coolants

SOCONY-VACUUM CORPORATION, New York City. Booklet entitled "Lubricants and Coolants for Metal Cutting," containing specific information pertaining to machining operations and the methods of supplying coolant on different types of machines, as well as recommendations for coolants to use in the machining of different kinds of materials. A chart is included giving, in convenient form, the coolant to use for performing any machining operation on the more generally machined metals.

Electrically Welded Iron Pipe

REPUBLIC STEEL CORPORATION, Youngstown, Ohio. Booklet 222-B, containing information and technical data on the manufacture, applications, and performance of Toncan

corrosion-resisting iron pipe. The booklet describes the properties of this pipe and its advantages for certain classes of service, and discusses the application of the electric resistance welding process to the production of Republic tubular products. Tables of sizes and weights, including list prices, are given.

Copper and Nickel Alloys

RIVERSIDE METAL CO., Riverside, N. J. Booklet on Riverside beryllium copper—a heat-treatable copper alloy. Catalogue on Riverside nickel silver, giving composition, properties, applications, and forms available. Bulletin giving the same information on phosphor-bronze as is given in the catalogue on nickel silver. Circular listing the outstanding characteristics and applications of Riverside free-cutting phosphor-bronze and free-cutting nickel silver.

Tool Grinders

WILLIAM SELLERS & CO., INC., 1602 Hamilton St., Philadelphia, Pa. Circular containing some valuable information on tool grinding, in which a comparison is made between line-contact grinding and surface-contact grinding. The application of line-contact grinding on the Sellers No. 2A tool grinder (designed especially for cemented-carbide and high-speed tools) is described in detail, and complete specifications of this machine are given.

Set-Screws and Cap-Screws

ALLEN MFG. CO., Hartford, Conn. Engineering data on Allen hollow set-screws and socket-head cap-screws. This publication shows the holding power and recommended sizes of set-screws and recommended tightening force of cap-screws. The information should be found valuable by designers and engineers, since nothing has been published in the past along these lines relating to hollow screws.

Gear-Hobbing Machines

LEES-BRADNER CO., Cleveland, Ohio. Circular describing the features of construction and operation of the Lees-Bradner single-spindle automatic gear-hobbing machine, which is designed to handle a wide range of work, being adapted for cutting straight or taper serrations, spline shafts, spur gears, worm-wheels, and helical gears (right or left hand, with angles up to 45 degrees).

Rubber Belting

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN, INC., Passaic, N. J. Leaflet outlining the advantages of the Condor "compensated" belt—a low-tension rubber belt which is so constructed that the stresses are equally borne by all the plies, and which is provided on the pulley side with a specially prepared surface possessing a high coefficient of friction.

Corrosion-Resistant Alloys

TITAN METAL MFG. CO., Bellefonte, Pa. Circular describing the physical properties and applications of two corrosion-resistant non-ferrous alloys —Tinicosil, suitable for use in hardware, ornamental fixtures, plumbing fixtures, etc., and Hitensiloy, which can be used for mechanical parts where high strength and a corrosion-resistance better than that of yellow brass, are required.

Centrifugal Pumps

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin illustrating and describing the Worthington monobloc two-stage centrifugal pumps intended for services requiring relatively small capacity and medium discharge head, such as air conditioning installations, refrigeration service, boiler return systems, etc.

Forging Hammers

C. C. BRADLEY & SON, INC., Syracuse, N. Y. Catalogue illustrating some of the outstanding advantages of Bradley forging hammers and typical examples of the application of these machines in actual service. The list of representative users included gives an idea of the diversity of industries served by Bradley hammers.

Aluminum-Bronze Die-Castings

AURORA METAL CO., INC., 614 W. Park Ave., Aurora, Ill. Bulletin 3, illustrating typical products made from aluminum-bronze die-castings, known by the trade name "Stronger-than-Steel." Details regarding the composition and characteristics of these die-castings are included.

Hardness and Elasticity Tester

SHORE INSTRUMENT & MFG. CO., Jamaica, N. Y. Bulletin R-4, illustrating and describing the Durometer and Elastometer, devices for measuring the hardness and elasticity of rubber under all conditions of commercial practice. Bulletin R-5, Guide for the Use of the Shore Durometer and Elastometer.

Cold-Drawn Steel

UNION DRAWN STEEL CO., Massillon, Ohio. Circular entitled "Nation-Wide Service Founded on 45 Years of Experience," containing a map of the United States showing the distribution of the plants and sales offices of the company and of the distributors' warehouses.

Rust Preventive

DEARBORN CHEMICAL CO., Chicago, Ill. Catalogue entitled "Proof of Results with No-Ox-Id in the Railroad Field," showing the wide range of uses for which this rust preventive is applicable and pointing out the savings in replacement costs made possible by its use.

Heating Units

GENERAL ELECTRIC CO., 10 Canal St., Schenectady, N. Y. Pamphlet entitled "Spots of Heat for Industrial Plants," showing illustrations in the form of a moving picture film of all kinds of electrical heating units for a variety of applications in industrial plants.

Potentiometer Pyrometers

BROWN INSTRUMENT CO., Philadelphia, Pa. Folder illustrating eight features of construction of the Brown potentiometer pyrometer on which the accuracy and dependability of the instrument are based.

Coil Winder

IDEAL COMMUTATOR DRESSER CO., Sycamore, Ill. Leaflet illustrating and describing the Ideal coil winder for producing almost any type of coil for armatures, fields, transformers, and similar purposes.

Coolant Filters

FOSTORIA PRESSED STEEL CORPORATION, Fostoria, Ohio. Circular describing the operation and the advantages of the Sorwal coolant filter for wet grinding, lapping, and honing operations.

Electrical Fittings

CROUSE-HINDS CO., Syracuse, N. Y. Bulletin 2265, containing data, including price lists, of Obround conduletes for threaded and threadless conduits.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market

American Rotary Continuous Surface Broaching Machine

External broaching operations can be performed at high rates of production in a rotary, continuous type of machine developed by the American Broach & Machine Co., Ann Arbor, Mich. As may be seen in the illustrations, the broaching tools are mounted in three holders, located around the rim of the column proper on a finished platen. This platen extends 190 degrees around the column. Production rates up to 2000 pieces per hour are obtainable.

Broaches of various lengths, depending upon the work, can be used. The first holder contains broaches for taking a roughing cut; the next holder, broaches for taking an intermediate cut; and the last holder, broaches that do the final sizing of the work. These broaches are made in sections that can be reground or replaced at minimum expense. As the sections become worn down, they can be moved to the stages ahead. The broaches can be reground an unlimited amount as they wear, because of the adjustment that is provided by using liners in back of the broach-holders. Minimum tool cost is therefore another advantage stressed by the manufacturer.

One of the important claims for the principle on which this machine is based is that the rotary movement of the work, in combination with stationary broaches that have a certain type of tooth, gives a shear cut that facilitates the removing of metal. The chips are different from those produced by other broaching methods. It is claimed that this shear effect lengthens the life of the tools to such an extent that over 200,000 pieces can be obtained with one set of tools.

The illustrations show the machine equipped with fixtures for simultaneously broaching four faces of yoke forgings. Ten work fixtures are mounted on the table. In this particular set-up, the table makes one revolution a minute, giving a production of ten pieces a minute. The broaching is thus done at the rate of 10 surface feet a minute.

After the operator loads a piece of work in any fixture, he pulls a lever slightly to turn the work back into a cradle, where pressure is applied on the lugs of the work piece. At the end of the finish broaching, the work is automatically loosened by a roll that comes into contact with the fixture lever. The machine can be equipped with an electric switch that will stop its operation instantly in the event that an improper forging or one that has not been correctly placed in a fixture advances toward the broaches.

The speed of table rotation can be increased or decreased to suit the class of work for which the machine is tooled. The table alone weighs 1 3/4 tons. It is mounted on large Timken roller bearings, one of which is approximately 18 inches in diameter. All bearings throughout the machine are

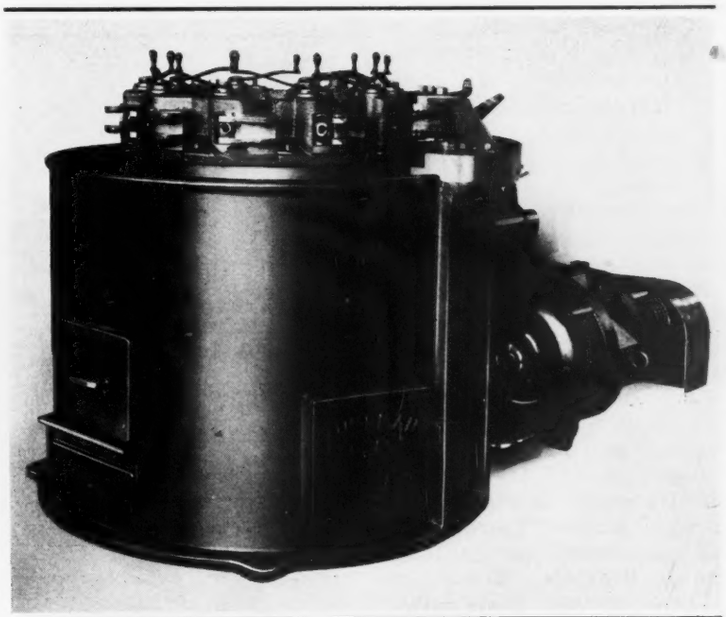


Fig. 1. Rotary Broaching Machine in which the Work Pieces are Carried Past Stationary Broach Units

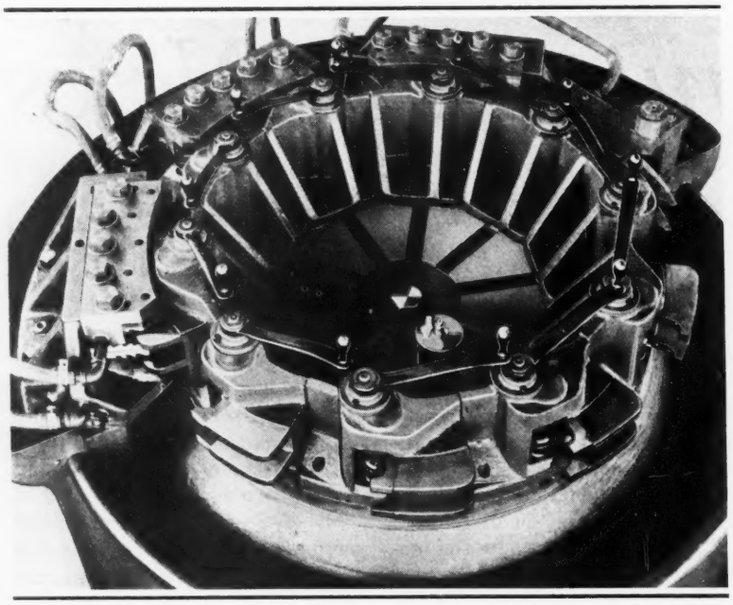


Fig. 2. A Rotary Broaching Machine with Ten Fixtures

Timken tapered roller bearings. The net weight of this machine is 12,400 pounds. For operation at maximum capacity, the manufacturer recommends a motor of 25 horsepower.

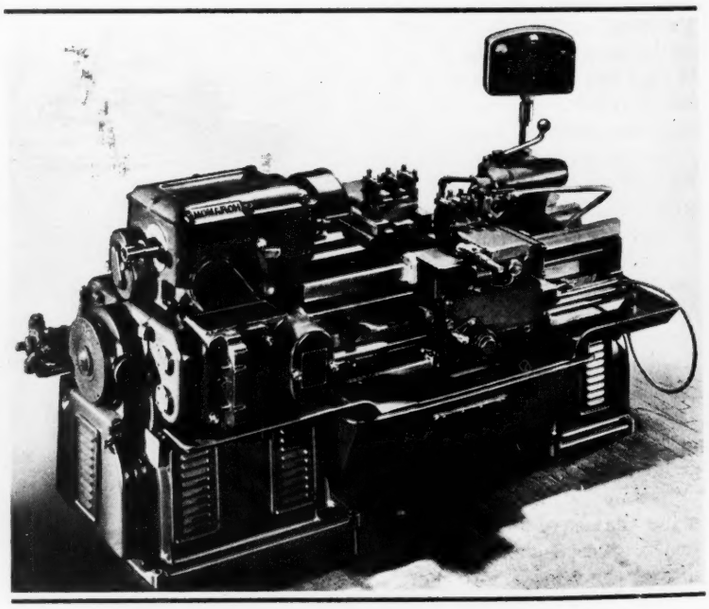
Monarch Magna-Matic Full Automatic Lathe

Complete electrical control is the outstanding feature of the Magna-Matic full automatic lathe recently developed by the Monarch Machine Tool Co., Sidney, Ohio. Magnetic clutches control both the feed and traverse of the front carriage, and of the front and rear tool-slides. There is also a magnetic clutch and brake for the spindle. Cams are not used in the operation of this lathe. Diameters and lengths of cut are controlled by limit switches.

There are four magnetic clutches in the front gear-box. Two of these provide the length feed and rapid traverse return of the front carriage. The other two, through the feed-rod and simplified gearing in the apron, provide "in-feed" and "out-rapid-traverse" movements or "in-rapid-traverse" and "out-feed" movements to the front carriage tool-slide. A lever on the front carriage apron makes it possible to instantly reverse the cycle of the tool-slide on that carriage, thus making it equally adaptable to out-facing or in-feeding operations.

The rear carriage is positioned manually at any point along the bed. The tool-slide on this carriage is controlled automatically by two magnet clutches in the rear gear-box. They provide an in-feed for facing or necking operations, and an "out-rapid-traverse-return." Pick-off gears at both the front and rear gear-boxes give seven feeds, ranging from 0.0046 to 0.0414 inch per spindle revolution. The rapid traverse of both tool-slides and of the front carriage is at the rate of 70 inches per minute.

The master control switch shown in the elevated position at the tailstock end of the machine gives a complete electrical control for both setting up and full automatic operation. The main starter button starts the feed of both carriages, in addition to starting the spindle. One button will reverse both carriages at any point in the cycle of operations, the carriages then returning quickly to their starting positions. Another button controls the front carriage and provides an "inching" movement to the front tool-slide and carriage for convenience in setting up. Another button gives an "inching" movement to the rear tool-slide. The cycle of the rear carriage



The Magna-Matic—a Full Automatic Lathe with Complete Electrical Control

can be timed before or after the front carriage cycle or at any intermediate point in relation to it.

In changing from one job to another, it is merely necessary, in addition to changing the tool set-up, to set micrometer stop-dogs for "in" and "out" front tool-slide diameter, for front carriage "length travel," and for rear carriage "in" and "out" feed travel.

Spindle speeds from 41 to 610 revolutions per minute are normally obtainable. This range can be stepped up or down, as desired. The spindle can be safely operated at speeds up to 1500 revolutions per minute.

This lathe can also be used with a single-point tool on the front carriage for turning to various diameters and lengths. A two-way electrical switch contacts with a templet for producing work on a production basis to an accuracy of closer than 0.001 inch.

An automatic feed set-up is supplied for the front carriage. This is a simple electrical control which permits automatic selection of the desired feeding rate for as many as four different diameters of a piece of work.

Waterbury-Farrel Roll-Feeding Straighteners

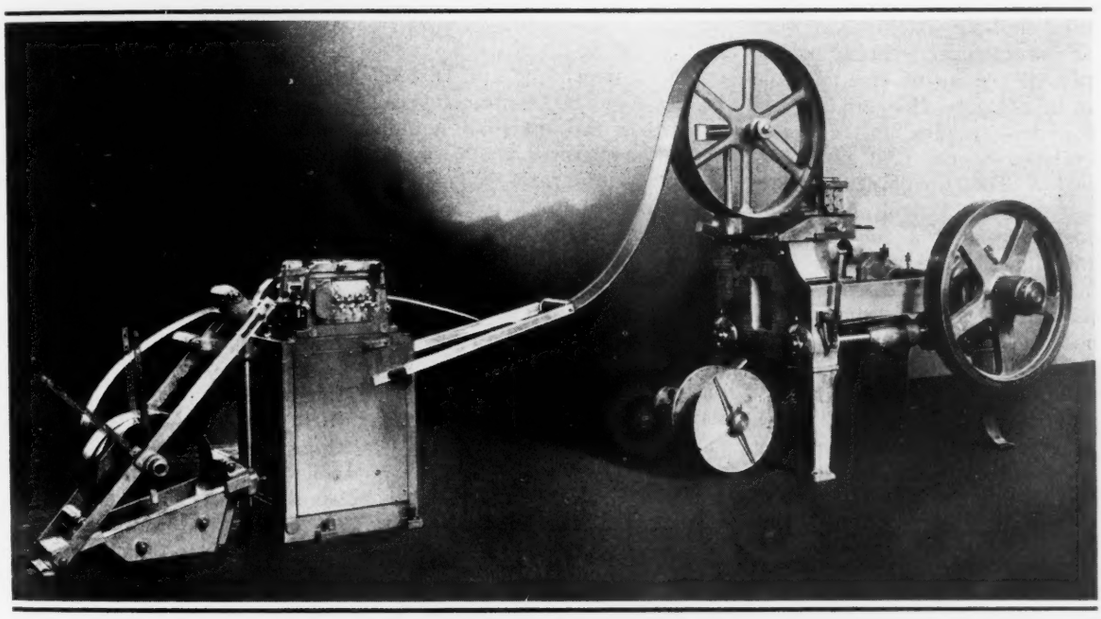
Three straightening machines designed for use as auxiliaries to punch presses to insure the production of flat blanks from coiled stock have been added to the line of the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. Because these straighteners adapt presses to the blanking of parts from coiled rather than strip stock, it is claimed that they save scrap, enable one man to operate several presses, lower costs, and reduce storage and operating space. They also eliminate the dragging effect of the coil on the stock being fed.

The illustration shows equipment intended for blanking such work as condenser plates and other radio parts, clock plates, clock gears, typewriter parts, etc. The outfit consists of a straightener, a special coil holder, and a horizontal press fitted with compound tools. The stock reel is designed to handle coils weighing up to 600 pounds.

The straightener is driven independently by a constant-speed motor. It is equipped with nine rolls and has a mechanical speed adjustment which can be set to feed any required amount of metal between the successive strokes of the press. An electrical control automatically stops the straightener from feeding when the press is shut down, and also stops it in the event that an excess of stock accumulates between the straightener and the roll feed attached to the press. The control also starts the straightener again after conditions such as these are corrected.

The press itself is equipped with a single-roll feed and a five-roll straightener. The latter device removes whatever bend may occur in the stock as it passes over the large feed wheel on the press and also corrects any slight inaccuracies of the larger straightener that may result from the difference in temper and gage between the various coils of stock. The entire feeding and straightening unit on the press may be swung away to make the tools accessible. A friction reel winds the scrap into coils after it has passed the tools.

The No. 2 straightening unit, which is used in conjunction with this press, has a capacity for



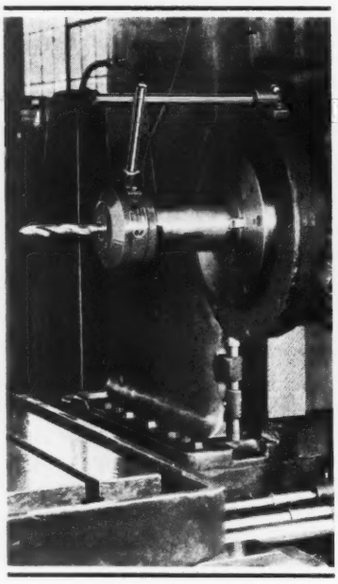
Waterbury-Farrel Straightener Feeding Stock from a Coil to a Horizontal Press

stock up to 1/16 inch thick by 8 inches wide. Another unit, known as the No. 1, handles stock up to 3/64 inch thick by 4 inches in width. There is a third unit of portable design which can be conveniently taken to various presses. This equipment has capacity for stock up to 1/10 inch thick by 12 inches wide.

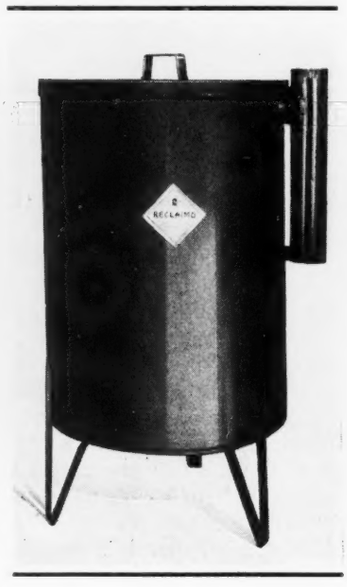
Ex-Cell-O Drill-Speeder Unit

When holes of small diameter are to be drilled on a horizontal boring and milling machine, a radial drilling machine, or similar equipment, speeds higher than the range of the machine can be obtained through the use of a drill-speeder unit recently developed by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich. The illustration shows one of these units installed on a boring mill. The shank or drive of the unit has a No. 5 Morse taper, while the nose of the speeder has a No. 3 Morse taper hole to accommodate drills up to 1 1/16 inches in diameter.

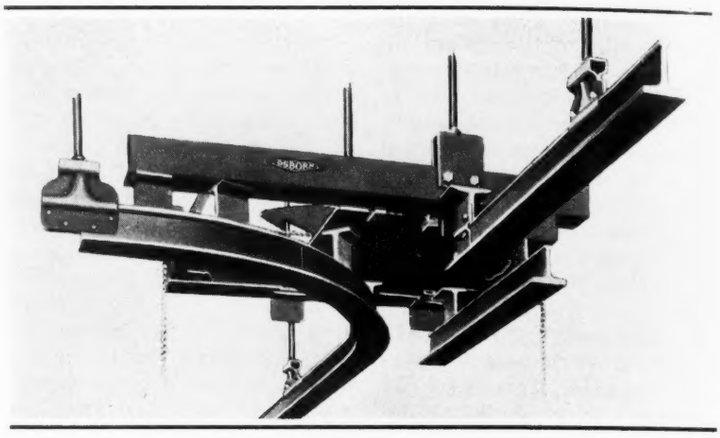
The ratio of this drill-speeder to the spindle speed of the machine on which the unit is used is 4 to 1. The maximum speed at which the machine spindle should be operated is 700 revolutions per minute, which gives a maximum drill speed of 2800 revolutions per minute. The housing of the speeder unit is provided with a boss in which a bar is inserted to engage a second bar mounted on the machine proper. The bracket for the bar on the machine is furnished with the unit but both bars are provided by the customer to suit the machine.



A Unit that Quadruples the Spindle Speeds of Machines



Equipment Intended for the Reclaiming and Re-refining of Oils



Tramrail Switch that is Combined with a Super-structure, Fittings, and Rails

Osborn Tramrail Sliding Switch

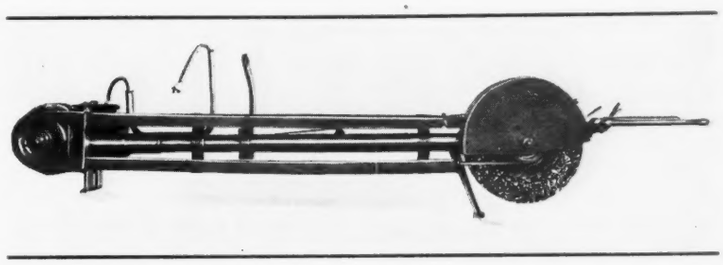
A tramrail switch embodying the switch proper, a supporting super-structure, fittings, and curved and straight T-rails, has been brought out by the Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio. Some of the features claimed for this switch assembly are that it minimizes the necessity for a super-structure, that fewer supporting fittings are required, that fewer holes need be drilled, and that bending and fitting of curves to the switch are eliminated. Also, erection time is reduced and less head-room is required. This switch is made with capacities up to 3 tons.

The curved and straight T-rails are welded to a sliding plate that is moved to either position of the switch on four rollers. Latches keep the switch locked in the desired position.

Schwalge Oil Reclaimer

Dirt and other foreign substances can be removed from oil by a "ReclaimO" oil reclaimer which is being placed on the market by the Imperial Devices Co., 3065 Fifth Ave., Chicago, Ill. This equipment will also correct acidity in oils and excess dilution. The manufacturer is the William Schwalge Co. of Chicago.

The equipment has a capacity for reclaiming 2 1/2 gallons of light oil, 2 gallons of medium oil, or 1 1/2 gallons of heavy oil per hour. The heating element operates on 110- or 220-volt alternating or direct current. The total weight is 120 pounds.



A Swing-frame Grinder of Welded Steel Construction that Provides Easy Operation

"Lectrogrinder"—A Grinder of the Swing Frame Type

A swing-frame grinder of welded steel construction that provides lightness, simplicity, and rigidity has been placed on the market by the Pittsburgh Engineering Works, Box 1125, Pittsburgh, Pa. This grinder is designed for convenient suspension from any form of crane or trolley support. The hanger is adjustable for balance, so that the desired proportion of the weight can be made to hang normally on the wheel. The grinder can be turned 90 degrees on its side when desired.

The spindle is provided with four roller bearings and a large grease chamber which need be refilled only at long intervals. The wheel centers are made with adjustable weights that provide for balancing the grinding wheel without removing it from the shaft. The driving motor is of a standard ball-bearing design and is completely enclosed and fan-cooled.

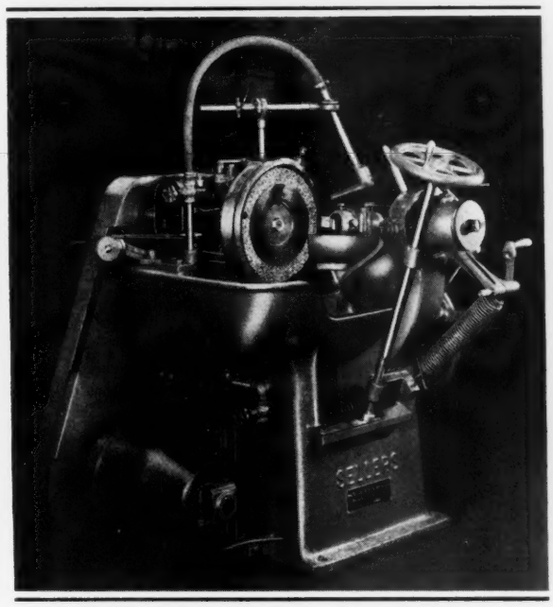
Sellers Improved Tool Grinder

To suit the machine for grinding cemented-carbide tools, the No. 2A tool grinder, made by William Sellers & Co., Inc., 1602 Hamilton St., Philadelphia, Pa., has been completely redesigned. Because there must be no vibration or looseness of the spindle when cemented carbide is being ground, the spindle of the improved machine is provided with a special preloaded ball-bearing mounting instead of the plain bronze bushing of the earlier model. Also, the spindle is now driven by a V-type belt and the pulley is mounted close to the bearings, as contrasted with the flat belt and greatly overhung pulley of the previous machine.

The spindle with its preloaded ball bearings is mounted in a large bronze sleeve which is oscillated axially by a protected cam revolving at a fixed speed. A heavy coil spring keeps the sleeve and cam in positive contact. On the old machine, an unprotected cam moved the spindle back and forth in its own bearings.

The grinding head has been redesigned for lubrication by a high-pressure grease-gun system. Backlash has been eliminated from the feed-screw that actuates the in and out movements of the chuck by using a heavy spring to insure positive contact between the screw and its nut.

The wheel guard can now be readily removed by loosening one knurled nut. This is particularly advantageous when cemented carbide and high-speed steel are both ground on the same machine, since it permits the grinding wheels to be interchanged rapidly. The motor is now mounted on the side of the machine and is provided with a convenient adjustment for belt tension. Although heavier than the old model, the improved machine requires less floor space.



Sellers Tool Grinder which has been Redesigned to Adapt it for Sharpening Cemented-carbide Tools

General Electric Plunger Type Relays

A complete line of instantaneous and time-delay plunger type relays for protection against over-current and under-voltage, and for use as auxiliary relays, has been developed by the General Electric Co., 10 Canal St., Schenectady, N. Y. The principle of operation

is common to the entire line; it depends upon the action of a magnet coil in attracting or releasing a plunger when predetermined values of voltage or current are present in the coil circuit.

The instantaneous over-current relay can be changed from time-delay on contact opening, contact closing, or both, by simply placing a poppet in the proper hole. Likewise, by turning a cap, the air intake or out-take to the bellows can be regulated to change the time delay in the opening or closing of the contacts. The bellows are made of a super-aging rubber which does not require lubrication and which is not affected by high or low temperatures, either in action or in durability.

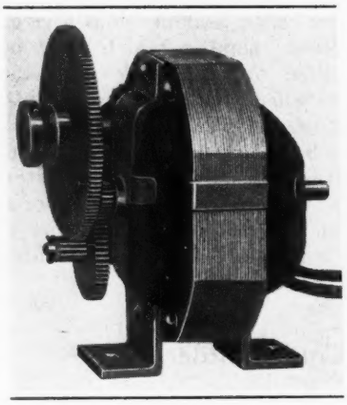
Sly Portable Sand-Blast Machine

Sand-blasting equipment intended for use as a general utility machine to clean castings, forgings, heat-treated steel parts, structural steel parts, etc., has been brought out by the W. W. Sly Mfg. Co., 4712 Train Ave., Cleveland, Ohio. The equipment consists essentially of a tank that can be mounted on legs or on wheels as shown. The outfit has an effective capacity of about 3 1/2 cubic feet of abrasive. Sand, metallic shot, or metallic grit can be used. The tank is operated by means of a single control valve.

Sly Pressure Blast Tank for Sanding Operations

Motor of One-Thousandth Horsepower

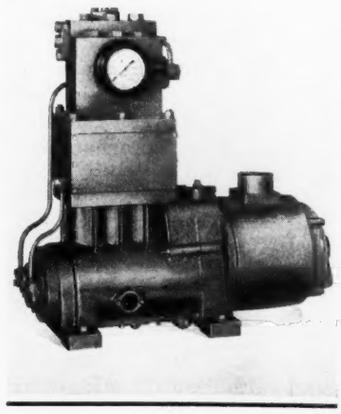
A motor with a capacity of 0.001 horsepower is a recent development of the Signal Electric Mfg. Co., Menominee, Mich., for use on small tools, display signs, toys, novelties, etc., when little power or starting torque is required. This motor is of a two-pole design with a center drive. The full load speed is 2300 revolutions per minute, and the net weight 1 1/4 pounds. The motor is available with and without a gear reduction. It is made for use on alternating current only.



Alternating-current Motor of One-Thousandth Horsepower Rating

Hydraulic Triplex Power Unit

A self-contained hydraulic power unit designed along the lines of a vertical automotive power plant has been developed for general commercial use by Kobe, Inc., Huntington Park, Calif. The unit is made in 3-, 7 1/2- and 15-horsepower sizes, having capacities of from 1 to 12 1/2 gallons a minute, for continuous service at pressures from 500 to 5000 pounds per square inch. Under conditions of intermittent duty, these pressures can be exceeded considerably. The unit can be installed as an integral part of a hydraulically operated machine.



Self-contained Power Unit for Hydraulically Operated Machines

The pump drive and the motor are completely enclosed, no gears, belts, or shaft connections being exposed. Lubrication is insured by a 30-pound system. With the exception of periodical changing of the crankcase oil, no maintenance is said to be necessary. The weight of the 7 1/2-horsepower unit, including the motor, is 625 pounds.

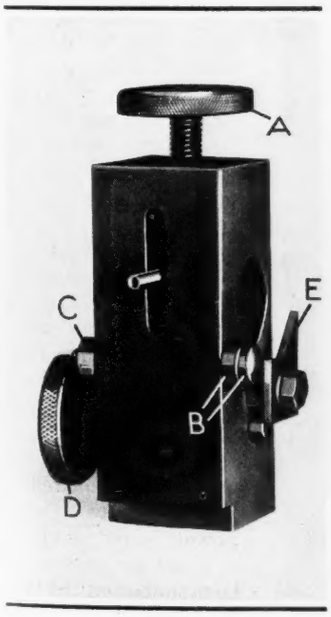
Red Devil Three-Burner Bench Furnace

A small gas bench furnace with three Bunsen burners has been added to the line of the Red Devil Mfg. Co., Bellwood, Ill., for use in sheet metal and machine shops, etc. This furnace has a firebox 6 1/2 by 6 1/2 by 5 inches, which is sufficiently large to permit heat-treating carbon-steel tools, heating the largest soldering irons, and melting small quantities of babbitt, lead, tin, zinc, and other soft metals. A flame temperature of 2250 degrees F. is produced. Except for the three burners and its larger size, this furnace is similar to the two-burner style described in July, 1933, MACHINERY, page 748.

Blaner Spring Winder

A tool for winding springs by hand is being manufactured by John Blaner, 629 Meek St., Sharon, Pa. This tool has capacity for winding 1/4-inch wire to a maximum pitch of 5/8 inch around a 1 1/8-inch mandrel. Any length of wire can be coiled and the wire may be of round or square cross-section. A special feature of the device is that compression or extension springs can be coiled at the same setting of the tool.

For winding a spring, the tool is clamped in a bench vise. Then a mandrel of the required size is slipped into the unit and the knurled-head screw *A* is tightened to place tension on the mandrel. The wire to be wound is next placed between the two brass washers *B* and connected to the mandrel or to a crank-handle. Nut *C* is now tightened to place tension on the wire. Finally, the knurled head *D* is tightened to adjust guide *E* in or out to suit the desired pitch of the spring. The guide is mounted on a square shaft which is actuated by a collar on the screw to which the knurled head *D* is attached.



A Device for Winding Springs by Hand

Marble-Card Splash-Proof Motors

Motors so designed as to be protected from falling or splashing water have been developed by the Marble-Card Electric Co., Gladstone, Mich., in both single-phase and polyphase squirrel-cage types and in sizes up to 30 horsepower. These motors are suitable for packing plants, laundries, breweries, paper mills, and other places where falling or splashing water or dirt is likely to damage a motor of the open type.

Marble-Card Motor, Designed to Provide Protection against Falling or Splashing Water

The new motors are fully enclosed except for small openings on the lower side of each end plate. These openings are so designed that water cannot enter the motor. The cooling system is such that the frame sizes are the same as for open-type motors of equal ratings.

Newton Junior Melting Pot

A portable melting pot intended for use in soldering, tinning, and dipping operations, in hardening small tools, etc., has been placed on the market by the Newton Junior Corporation, 151 Court St., New Haven, Conn. This pot will melt and keep in the molten condition metals or other materials having a melting point as high as those of tin and solder. Low first cost and low operating costs are advantages.

Pot with a Melting Period of Only Twenty Minutes

A closely balanced operating temperature can be maintained. After the normal heating temperature has been reached, the pot temperature will remain practically constant over any period of operation. When filled to capacity, the melting period is only about 20 minutes. The pot has a capacity of 4 pounds, an over-all height of 4 1/4 inches, and an over-all width of 6 3/4 inches. It operates at maximum capacity on 275 watts.

Cutanit—A Titanium Carbide

A titanium carbide which is intended for cutting different metals and is said to possess superior qualities for machining steel is being placed on the market by American Cutting Alloys, Inc., 347 Madison Ave., New York City, under the name of "Cutanit." One grade is suitable for cutting all materials.

In addition to its suitability for cutting tools, Cutanit may be used for surfaces subject to abrasive wear, such as the tips of micrometers and the measuring surfaces of snap gages.

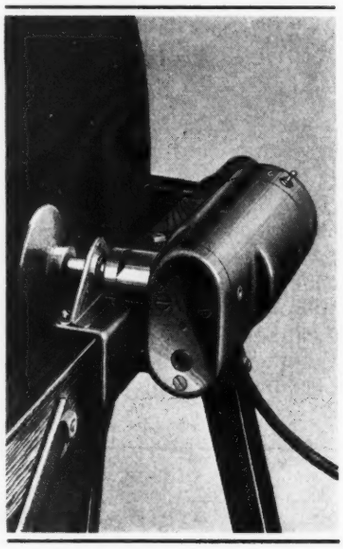
The advantages claimed for this material are that cuts can be taken at unusually high speed; that heavy cuts can be taken; and that a very fine finish can be ob-

tained in combination with close tolerances. Titanium carbide is said to be unusually resistant to oxidation and capable of withstanding much heat. The cutting edge of Cutanit tools remains sharp and smooth for a long period, thus permitting long runs of work between grinds. Unusual smoothness of cuts is a feature that results from the chemical composition and microstructure. The material stands up well under heavy and interrupted cuts.

G-E Fractional Horsepower Motors

Series-wound and shaded-pole motors of fractional horsepower are being introduced on the market in completely new lines by the General Electric Co., 10 Canal St., Schenectady, N. Y. The series-wound motors are intended for use on portable tools, office devices, etc. They have been designated as Type P, and are available with universal characteristics in most speed ratings, so that the same motor can be operated on either alternating or direct current. The motors are adapted for special mounting conditions and unusual service requirements. The motors are available in sizes from 1/100 to 1/3 horsepower, for speeds up to 10,000 R.P.M.

The fractional-horsepower, shaded-pole motors are known as Type KSP. These motors have been developed for driving a large variety of devices, such as small fans, blowers, thermostats, valves, and timing devices. The motors incorporate such mechanical features as spiralled rotor slots and a cast-aluminum, squirrel-cage winding. Ratings from 1/250 up to 1/60 horsepower are available.



Fleming Motor Drive for Grindstones

A Motorized Grindstone

An electrically operated grindstone has recently been developed by George W. Fleming, and is being introduced on the market by the Fleming Electric Tool Division of the Loring Coes Co., Worcester, Mass. This grindstone is driven by a universal type of motor which will run on either direct or alternating current of 110 volts. A gear reduction gives a grindstone speed of 60 revolutions per minute.

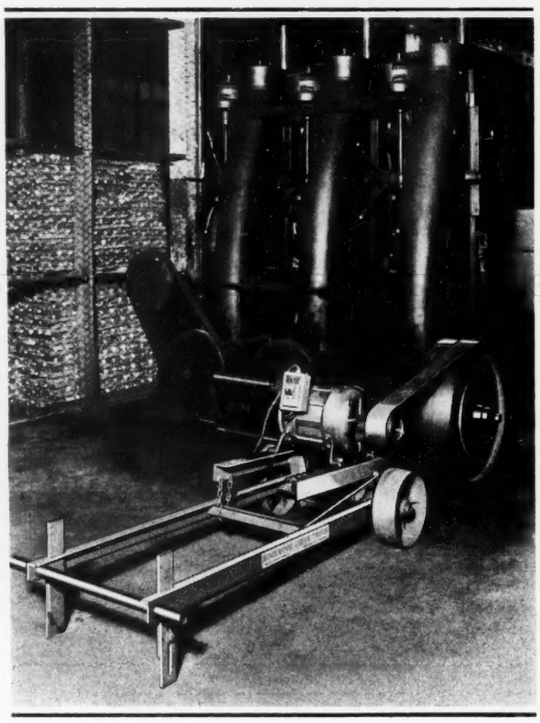
The motor is connected to the grindstone by an over-riding clutch, which removes all strains from the gear-shaft bearings and the motor when the current is turned off. The centrifugal force stored up in a wheel causes it to revolve freely while the motor comes to rest independently.

Rockwood Portable-Drive Truck

A hand truck that may be equipped with a motor of from 2 to 10 horsepower and a short-center drive, for transmitting power to machinery about an industrial plant or in the field, has recently been brought out by the Rockwood Mfg. Co., 1801-2001 English Ave., Indianapolis, Ind.

This truck is convenient for such applications as testing out new machines before placing them permanently in production. In such an application, the machine can be placed in operation in much less time than it would take to fasten a motor to the floor, cut a belt to suit, line up pulleys, etc. Usually a machine can be placed in operation within five minutes.

The truck has pivoted arms that will accommodate motors up to 450 pounds in weight. The arms so cradle the motor as to give complete control of the belt tension. When such an outfit is required in places where electric power is not available, a gasoline engine can be mounted on the truck to serve as the power unit, instead of an electric motor.



Using the Rockwood Portable-drive Truck

Bullard Hydro-Shift Vertical Turret Lathe

Complete flexibility, accessibility, and ease of operation were objectives in designing the line of Hydro-Shift vertical turret lathes now being introduced to the trade by the Bullard Co., Bridgeport, Conn. These machines are built in 56-, 66-, 76-, and 86-inch sizes. One of the outstanding features—from which they derive their name—is a hydraulically operated speed-shifting mechanism. Sixteen table speeds are available and they are selected by means of a direct-reading dial that is turned through a crank lever.

For example, assume that the table of the 56-inch machine is running at the rate of 3.1 revolutions per minute, and that a higher speed is desired. The operator would merely set the dial to the desired speed, move a clutch lever to bring the table to a full stop, and then throw the clutch lever back into engagement. In the interval, gears will have been shifted hydraulically, as required, to give the speed indicated by the dial.

Other new features, mechanical and electrical, have been incorporated in the machine to afford efficiency and economy of operation. Anti-friction bearings are used throughout, with the exception of the table bearing. Strength and rigidity have been prime considerations in order to insure the elimination of vibration and to give a firm support for the cross-rail and the main and side heads.

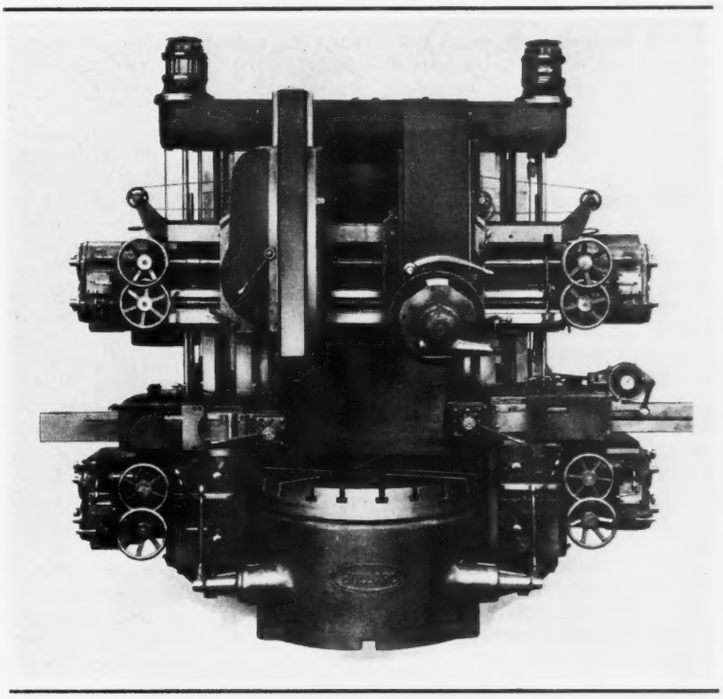
The cross-rail is provided with an individual motor for driving the raising and lowering screws. Two heads are accommodated by the cross-rail. The machine illustrated is equipped on the left-hand side with a ram type of head for boring and on the right-hand side with a turret head.

The turret is indexed by means of a crank-handle which drives through a worm-gear. This precludes the possibility of a kick-back of the crank when heavy bars or tools overbalance the weight of tools in other stations as the turret is indexed. Each of the head slides may be swiveled to the right or left up to 30 degrees. The two heads on the cross-rail are provided with individual feed mechanisms that permit a rapid traverse, vertically or horizontally, independent of each other, and enable separate feeds for the individual heads.

Two side heads have been adopted to increase the scope and efficiency of these machines. To eliminate vibration and weave, these side heads are one-piece castings and they are mounted directly on the ways of the bed. The slides of each are provided with four-face indexing turrets. To make the side heads truly flexible, they are also individually equipped with feed works. Various combinations of movements are available for either side head and its slide.

Direct-reading dial controls on each feed mechanism permit the convenient changing of feeds of any head without stopping the table or other feed works. Observation stops on the direct-reading micrometer dials provide a quick means of duplicating sizes of work after the first setting has been completed. Levers control the start and direction of feeds, and trip levers on the feed works provide a means of instantly stopping the feed of the respective heads by the mere pressure of a finger.

The power traverse handles are so designed as to immediately spring into neutral when the hand pressure is released, thereby avoiding the danger of leaving a head in traverse. An automatic overhead kick-out prevents serious damage due to jamming or overloads. Selector dials with a knob control on each feed mechanism give a range of sixteen feeds. Clutch levers are located on each side of the table for conveniently controlling the table and the feeds of all heads. This control is, of course, in addition to the individual controls on the feed units. These machines range in weight from 52,000 to 77,000 pounds.



Bullard Vertical Turret Lathe with a Hydraulic Speed-shifting Arrangement

NEWS OF THE INDUSTRY

Canada

BRISTOL CO., Waterbury, Conn., announces that in order to serve the Canadian market better and to consolidate its present Canadian service laboratory to include sales, service, and manufacturing, a separate company known as the BRISTOL CO. OF CANADA, LTD., has been incorporated. The factory and general headquarters will be at 64 Princess St., Toronto, Ontario, Canada, where Bristol recording, indicating, and control instruments will be manufactured. J. S. MAYBERRY, who has been with the parent company for ten years, has been appointed manager.

Illinois, Indiana and Michigan

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill., recently held a three-day national sales convention at the Chicago plant, which was attended by members of the organization from all over the United States. There were over two hundred men in attendance at the various sessions. The president, Edward L. Ryerson, Jr., welcomed the group at the opening session and later discussed the situation and problems of the coming year. The sessions were devoted to talks and discussions of the changing industrial conditions, objectives for 1934, advertising, sales promotion, the new Ryerson products, improved selling methods, etc. The occasion was closed by a banquet at the Union League Club.

AJAX ELECTROTHERMIC CORPORATION, Trenton, N. J., has engaged R. A. BULL to devote part of his time as consultant and mid-west representative, with an office at 541 Diversey Parkway, Chicago, Ill. Major Bull was director of the Electric Steel Founders' Research Group during the thirteen years of its existence, and has had a wide experience in steel founding gained as a manufacturing executive with the American Steel Foundries, Commonwealth Steel Co., Duquesne Steel Foundry Co., and other concerns. He is a past-president of the American Foundrymen's Association and was awarded the Seaman Gold Medal for his contributions to foundry practice.

HOMER B. (Tex) JOHNSON, formerly representative in the Chicago district for the Pratt & Whitney Co., has been appointed western divisional manager of the Sheffield Machine & Tool Co., Dayton, Ohio, manufacturer of precision gages. The Chicago headquarters are at 549 W. Washington Blvd.

JOSEPH P. BALDEZ, salesman for the Cincinnati Milling Machine Co. and Cincinnati Grinders, Inc., has been transferred from the Cincinnati territory to the Chicago office, 2400 W. Madison St., Chicago, Ill. Mr. Baldez will cover the northern half of Chicago, the north central section of Illinois, and the southeastern part of Iowa.

MERCURY MFG. CO., 4118 S. Halsted St., Chicago, Ill., maker of tractors, trailers, and lift trucks, has appointed THOMAS W. BARNES to the Chicago sales staff. Mr. Barnes has had a long experience in the field of industrial materials-handling equipment, and until recently was vice-president of W. F. Hebard & Co.

BANTAM BALL BEARING CO., 3400 W. Sample St., South Bend, Ind., manufacturer of ball and roller radial and thrust bearings, announces that it is now represented in the Chicago territory by R. B. NICHOLS, 1835 E. 78th St. Mr. Nichols has been associated with the Bantam Ball Bearing Co. for many years and has recently handled the southern Indiana and southern Ohio territory, from which he was transferred on December 1 to the Chicago district. The company also announces that E. T. COBB is acting as representative for industrial ball bearings and roller bearings in the state of Tennessee, with headquarters at Pine Valley, Miss.

REED-PRENTICE CORPORATION, Worcester, Mass., manufacturer of machine tools, including engine, tool-room, and production lathes, vertical milling and die-sinking machines, special production machinery, etc., announces the appointment of J. C. AUSTERBERRY'S SONS, 684 E. Congress St., Detroit, Mich., as exclusive agents for the Detroit territory.

New England

HARRY K. CLARK has been promoted from sales manager of the Grinding Wheel Division of the Norton Co., Worcester, Mass., to general sales manager. WILLIAM R. MOORE, director of market research, becomes sales manager of the Grinding Wheel Division. HUGH D. BUTLER has joined the Norton organization as director of market research and will have charge of the market research of the Norton Co. and its affiliates, the Behr-Manning Corporation and the Norton Pike Co. ROBERT KIRKPATRICK has been appointed assistant sales manager of the Abrasive Products Division. For the last four years he has been sales manager of the Refractories Division.

THOMSON-JUDD WIRE MACHINERY CO., a subsidiary of the Thomson-Gibb Electric Welding Co. of Lynn, Mass., elected Arthur R. Petterson to the office of vice-president, succeeding the late Josiah Judd who died December 19, 1933. The other officers of the Thomson-Judd Wire Machinery Co. are as follows: President, George A. Cutter; secretary, D. J. Lyne; assistant secretary, William T. Ober; treasurer, A. P. Reed.

SENTRY CO., manufacturer of industrial furnaces and other heat-treating equipment, announces that the company has moved from Taunton, Mass., into its new plant at 62 Main St., Foxboro, Mass., where increased facilities are available.

FRANKLIN R. HOADLEY, vice-president of Farrel-Birmingham Co., Inc., Ansonia, Conn., has been elected president of the Gray Iron Founders' Society. Mr. Hoadley was born in Ansonia in 1890. After his graduation from Yale University in 1914, he started with the Farrel Foundry & Machine Co. as a foundry apprentice. During the war he served as lieutenant in the Ordnance Department, first in this country and later overseas. In 1919, he was made foundry manager of the Farrel Foundry & Machine Co. In 1927, he was made a director of the newly formed Farrel-Birmingham Co., Inc., and in 1930, vice-president.

Franklin R. Hoadley, President Gray Iron Founders' Society

New Jersey and Pennsylvania

NEW JERSEY GEAR & MFG. CO., 38 Stanton St., Newark, N. J., has acquired the machinery, tools, and good will of the MEISSELBACH-CATUCCI MFG. CO. of Newark. The president of the concern is A. FAILLA, and the secretary-treasurer is A. WALLIN, both of whom were formerly associated with the Meisselbach-Catucci Mfg. Co. The New Jersey Gear & Mfg. Co. is specializing in gears from 1 to 200 diametral pitch in all materials and styles, including spur, spiral, internal, bevel, and worm gears. Other specialties are

spur or spiral pinion rod; gears and gear trains for meters; spring motors; speed reducers; and airplane and other instruments.

THEODORE M. GLOECKNER, who has been associated with the sales organization of the Union Drawn Steel Co., Massillon, Ohio, for more than fifteen years, has been appointed district sales manager for the Philadelphia territory, with headquarters at 2030 Fidelity-Philadelphia Trust Bldg. During most of his association with the company, Mr. Gloeckner has been located in the Philadelphia district and has been in charge of the Philadelphia office for the last year and a half.

L. R. CALVERT has been appointed works engineer of the Westinghouse Lamp Co., East Pittsburgh, Pa., succeeding the late E. J. Smith, to whom he was an assistant for a number of years. Mr. Calvert's headquarters will be in Bloomfield, but he will have direct supervision over the plant maintenance of all company manufacturing properties, including factories in Belleville and Trenton, N. J.

RODNEY DAVIS, 624 Race St., Philadelphia, Pa., has been appointed by the Diamond Chain & Mfg. Co., Indianapolis, Ind., as distributor for Diamond roller chains, sprockets, couplings, and special chains for the Philadelphia district.

New York

S. KRASILOVSKY & BRO., INC., 216 Centre St., New York City, obtained the contract for moving from the Port of Authority Building to shipping points, all of the machinery that made up the Ford Thirty Years of Progress Exposition, recently held in New York City. The importance of this contract may be judged from the fact that the exhibit consisted of some sixty machines, weighing a total of about 1500 tons. Individual machines weighed as much as 43,000 pounds.

CONRAD TRUBENBACH, long associated with the Max Ams Machine Co., as treasurer and sales manager, has established a new company known as the TRUBE CO., with offices at 101 Park Ave., New York City, to furnish a comprehensive engineering service and to supply high-grade can-making and sheet-metal working machinery and equipment of all kinds.

PROFESSOR COLIN G. FINK of Columbia University, New York City, was presented with the Perkin Medal of the Society of Chemical Industry at its meeting, January 5, at the Chemists' Club, New York. This medal is awarded each year for valuable work in applied chemistry and has been presented to Professor Fink this year for his inventions in the fields of metallurgy and electrochemistry.

F. P. HARRIGAN has been appointed sales representative in the metropolitan area for the Sheffield Machine & Tool Co., Dayton, Ohio, manufacturer of precision gages. The New York office is located at 30 Church St.

Ohio

C. B. CROCKETT, former secretary of the Industrial Truck Association, and more recently a partner in the firm of Crockett, Lightner & Smith, engineers of New York City, has joined the Cleveland Tractor Co., Cleveland, Ohio, as sales engineer, to develop the application of Cletrac crawler tractors to the problem

C. B. Crockett, Sales Engineer Cleveland Tractor Co.

of material moving in industrial plants and for more general purposes in railway use.

EARL C. SMITH, chief metallurgist of the Republic Steel Corporation, Youngstown, Ohio, addressed a meeting of the Boston chapter of the American Society for Steel Treating on January 5, at the Massachusetts Institute of Technology, Cambridge, Mass., on the subject of stainless steels. Mr. Smith's address was supplemented by a large display of stainless steel products, illustrating various methods of fabrication. He discussed the production, working methods, and qualities of the stainless steels, demonstrating their workability with actual products. He also described the rapid progress made by stainless steel in a number of industrial fields, citing many examples of successful applications.

W. W. SLY MFG. CO., 4700 Train Ave., Cleveland, Ohio, is celebrating its sixtieth anniversary this year. The company is a pioneer in foundry cleaning-room equipment and dust collection. After an experience of a number of years in the foundry industry, W. W. Sly, the founder of the company, established his own business in 1874 for the manufacture and sale of tumbling mills of the exhaust type, one of his own inventions. He soon realized the necessity of collecting the dust from the tumbling mills in a positive manner, and developed and put on the market the Sly cloth-screen-type dust collector. This led to the development of the present extensive line of Sly casting cleaning equipment.

KARL KAUTZ, ceramic engineer, has joined the staff of the Republic Steel Corporation, Youngstown, Ohio. Mr. Kautz will specialize in research and field service on enameling sheets. He graduated from the Ohio State University with the degree of Master of Science, and has had ten years' experience with prominent firms in various branches of vitreous enameling.

HAROLD A. HALLSTEIN, general auditor of the Austin Co., Cleveland, Ohio, engineers and builders, has been made a vice-president of the company. Mr. Hallstein also will continue his duties as general auditor, a position he has held for seven years.

COMING EVENTS

FEBRUARY 28-MARCH 1—Third annual WELDING CONFERENCE conducted by the Department of Industrial Engineering, OHIO STATE UNIVERSITY, Columbus, Ohio. Technical papers will be read and there will be exhibits and demonstrations by manufacturers of welding equipment and supplies. Further information can be obtained from Professor O. D. Rickly, Department of Industrial Engineering, Ohio State University, Columbus, Ohio.

MARCH 7—Regional meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Washington, D. C. C. L. Warwick, secretary-treasurer, 260 S. Broad St., Philadelphia, Pa.

MARCH 12-16—Fourth annual PACKAGING EXPOSITION at the Hotel Astor, New York City, under the auspices of the AMERICAN MANAGEMENT ASSOCIATION, 232 Madison Ave., New York City.

JUNE 25-29—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary-treasurer, 260 S. Broad St., Philadelphia, Pa.

JULY 3-9—FOURTH INTERNATIONAL CONGRESS FOR APPLIED MECHANICS to be held at Cambridge, England. For detailed information, address Applied Mechanics Division, American Society of Mechanical Engineers, 29 W. 39th St., New York City.

OBITUARIES

Edward James Kearney

EDWARD JAMES KEARNEY, secretary-treasurer of the Kearney & Trecker Corporation, Milwaukee, Wis., and one of the leaders in the American machine tool industry, died January 12 of pneumonia at the age of sixty-six years.

Mr. Kearney was born in a log cabin, one hundred miles from the nearest railroad, in Mitchell County, Iowa, in 1868. His mother died when he was five years old and his father, a Civil War veteran, died seven years later, leaving him alone in the world at the age of twelve. At this time he was riding a 60-mile range in charge of a herd of two hundred and fifty short-horn cattle near Garner, Iowa. Whenever he could, he would visit an old blacksmith on the edge of the range, who had a mechanical turn of mind and introduced him to the reading of technical magazines. It was through this association that he developed the ambition to become a mechanical engineer.

Through the interest of a railroad foreman, who had served in the Civil War with his father, he obtained a job as engine wiper in a roundhouse at Egan, S. D. He made a habit of saving half of his salary of $50 a month, and eventually entered the Iowa State College at Ames, where he graduated with the class of 1893.

Coming to Milwaukee, he obtained employment in the locomotive shops of the Chicago, Milwaukee & St. Paul Railroad, later entering the employ of the Kempsmith Machine Tool Co. as a draftsman. Here he remained for four years.

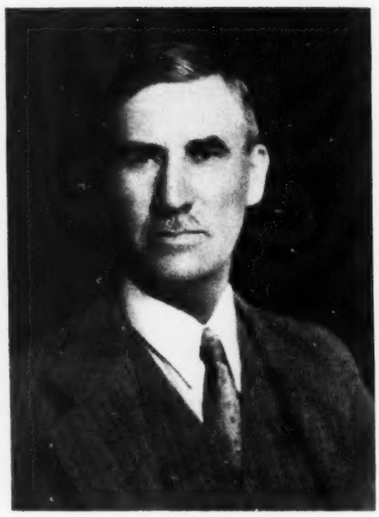
In 1898 he organized, with Theodore Trecker, the partnership of Kearney & Trecker, which was incorporated in 1906. Beginning in a very small way, this company has grown into one of the leading machine tool building plants in the country, specializing in milling machines.

In referring to the founding of this partnership, it would be amiss to omit mentioning how Mr. Kearney used to ascribe his partnership with Mr. Trecker to Admiral Dewey's victory at the battle of Manila. "The partnership which I formed with Mr. Trecker," Mr. Kearney once said, "was the result of an agreement we made that if the Admiral won, we would go into business for ourselves; and if he lost, we would retain our jobs in the West Milwaukee shops of the St. Paul Railroad."

Apart from his activity in his own business, Mr. Kearney gave much time and thought to the interests of the machine tool industry as a whole. He served as president of the National Machine Tool Builders' Association in 1923, and was always active in furthering the best interests of the industry. He also became a director of the American Exchange Bank of Milwaukee in 1913, acting chairman of the board of directors in 1919, and president in 1920.

During the World War he was director of the Liberty Loan Committee for Wisconsin. Always interested in public affairs, he was at one time a member of the Wisconsin State Vocational School Board and a trustee of the Milwaukee-Downer College. He was also a member of the American Society of Mechanical Engineers.

In personal character and achievement, Mr. Kearney was ever recognized as one of the outstanding leaders of the machine tool industry, whose influence could always be counted upon on the side of progress and high principles. His passing away means a loss to the entire industry which will be deeply felt.



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Edward James Kearney

In 1895, Mr. Kearney married Ella Berdine Morton, who survives him. He is also survived by two married daughters and a grandson.

HERBERT T. HERR, a vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and a noted engineer, died recently at his home in Philadelphia, following an illness of about five months. Mr. Herr was born in Denver, Colo., in 1876. He was widely known in engineering circles as the inventor of locomotive air brake equipment, improvements in turbines, oil and gas engines, and remote control for steam turbines. Among the technical associations of which he mas a member may be mentioned the American Society of Mechanical Engineers, the American Institute of Mining Engineers, the American Society of Naval Engineers, and the American Society of Naval Architects and Marine Engineers.

ARTHUR A. BROWN, assistant to vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., died suddenly at his home in Mount Vernon, N. Y. He was born in Three Creeks, Union County, Arkansas, on January 4, 1873. After studying mechanical engineering for three years at the University of Illinois, he went to work for the Bethlehem Steel Co. at South Bethlehem, Pa., as a machinist. Later he served successively as assistant superintendent of the H. B. Smith Co., general superintendent of the Richmond Co., of Norwich, Conn., and general manager of the Rarig Engineering Co. of Columbus, Ohio. His employ with the Westinghouse organization began in 1904, when he gave up industrial work and entered the sales department of the Westinghouse Machine Co. in Pittsburgh. From 1909 to 1926, he had charge of all syndicate operations of the Westinghouse Electric & Mfg. Co., and in 1926 was appointed assistant to vice-president, which position he held at the time of his death.

GIUSEPPE FACCIOLI, former works engineer and associate manager of the Pittsfield, Mass., Works of the General Electric Company, died in Pittsfield, January 13, about four years after his retirement because of ill health. Mr. Faccioli was born in Milan, Italy, in 1877. He came to this country nearly thirty years ago, following his graduation from the University of Milan. Here he was first employed by the New York Edison Co., and later by the Interborough Rapid Transit Co. He then became a designing engineer for the Crocker Wheeler Co., following which he became associated with William Stanley.

When the Stanley firm was absorbed by the General Electric Company, Mr. Faccioli became associated with the railway department of the company at Schenectady, and later at Pittsfield. In 1913, he was appointed works engineer of the Pittsfield plant, and in 1927 became associate manager.

THOMAS A. MCLOUGHLIN, a pioneer in the electrical industry and for twenty-five years recording secretary of the sales committee of the General Electric Co., died at his home in Schenectady on January 8 after a long illness.

Mr. McLoughlin was born in Scotland in 1864 and came to this country at an early age. In 1888 he entered the Boston office of the Thomson-Houston Co. and in 1892, when that company was combined with the Edison General Electric Co. to form the General Electric Co., he was retained at the Boston office. From that time until April, 1932, when he was retired, he had been connected with the General Electric organization.

JOSIAH JUDD, vice-president and general manager of the Thomson-Judd Wire Machinery Co., a subsidiary of the Thomson-Gibb Electric Welding Co. of Lynn, Mass., died December 19, 1933, at New Haven, Conn. Mr. Judd's death was caused by a heart attack brought on by the after effects of a minor operation. Mr. Judd was in his sixty-third year. Previous to the formation of the Thomson-Judd Wire Machinery Co., Mr. Judd was president of the Wire Machinery Co. of America, located at New Haven, Conn.